

HAMILTON 1986

AIR QUALITY SURVEY  
IN THE VICINITY OF  
DOMTAR, DOFASCO, STELCO,  
COLUMBIAN CHEMICAL  
AND THE  
INDUSTRIAL SECTOR  
OF  
HAMILTON  
OCTOBER 1986

ARB-144-87-AQM

FEBRUARY 1988

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Ministry  
of the  
Environment

E. PICHÉ, Director  
Air Resources Branch

ISBN 0-7729-3047-3

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The West Central Region  
Ontario Ministry of the Environment

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FEBRUARY 1988

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## EXECUTIVE SUMMARY

At the request of the West Central Region, Mobile Air Monitoring Unit #1 of the Air Resources Branch undertook an ambient air quality survey in the downtown and industrial sectors of Hamilton from October 6 to 17, 1986. The main aims of this survey were to determine the air quality in these areas and if possible, to investigate the air quality in the vicinity of several industries north of Burlington Street, namely; the Domtar (Cassidy Works) tar plant, Columbian Chemical, and the Stelco and Dofasco steel mills. The results of this survey were also to be compared with a similar study that was conducted in the fall of 1985.

From the air quality data acquired during the 1986 survey, oxides of nitrogen, naphthalene and total reduced sulphur compounds were found to be potential environmental problems. Measurements of the air quality downwind of Stelco resulted in a maximum half-hour average ground level concentration of 0.47 parts per million (ppm) for oxides of nitrogen. The applicable Ministry Air Quality Standard for this contaminant is 0.25 ppm. Half-hour average concentrations ranging up to 330 micrograms per cubic metre ( $\mu\text{g}/\text{m}^3$ ) of naphthalene were detected downwind of the Domtar (Cassidy Works) tar plant. In April of 1987, the Ministry adopted an Air Quality Provisional Guideline of 36  $\mu\text{g}/\text{m}^3$  for naphthalene. Half-hour average concentrations of total reduced sulphur compounds ranging up to 0.120 ppm were detected downwind of the Domtar plant whereas concentrations of about 0.005 ppm were generally detected throughout the industrial sector. No Ministry Air Quality Guideline is available for total reduced sulphur compounds from tar plants, although the Provisional Guideline for total reduced sulphur compounds from kraft pulp mills is 0.027 ppm.

A great deal of similarity was noted in the 1985 and 1986 air quality data sets. Naphthalene, total reduced sulphur compounds and oxides of nitrogen were determined to be significant gaseous contaminants during both of these surveys. Whereas for the other contaminants, none of the applicable Ministry Air Quality Standards, Criteria, Guidelines or Provisional Guidelines were exceeded or even approached.

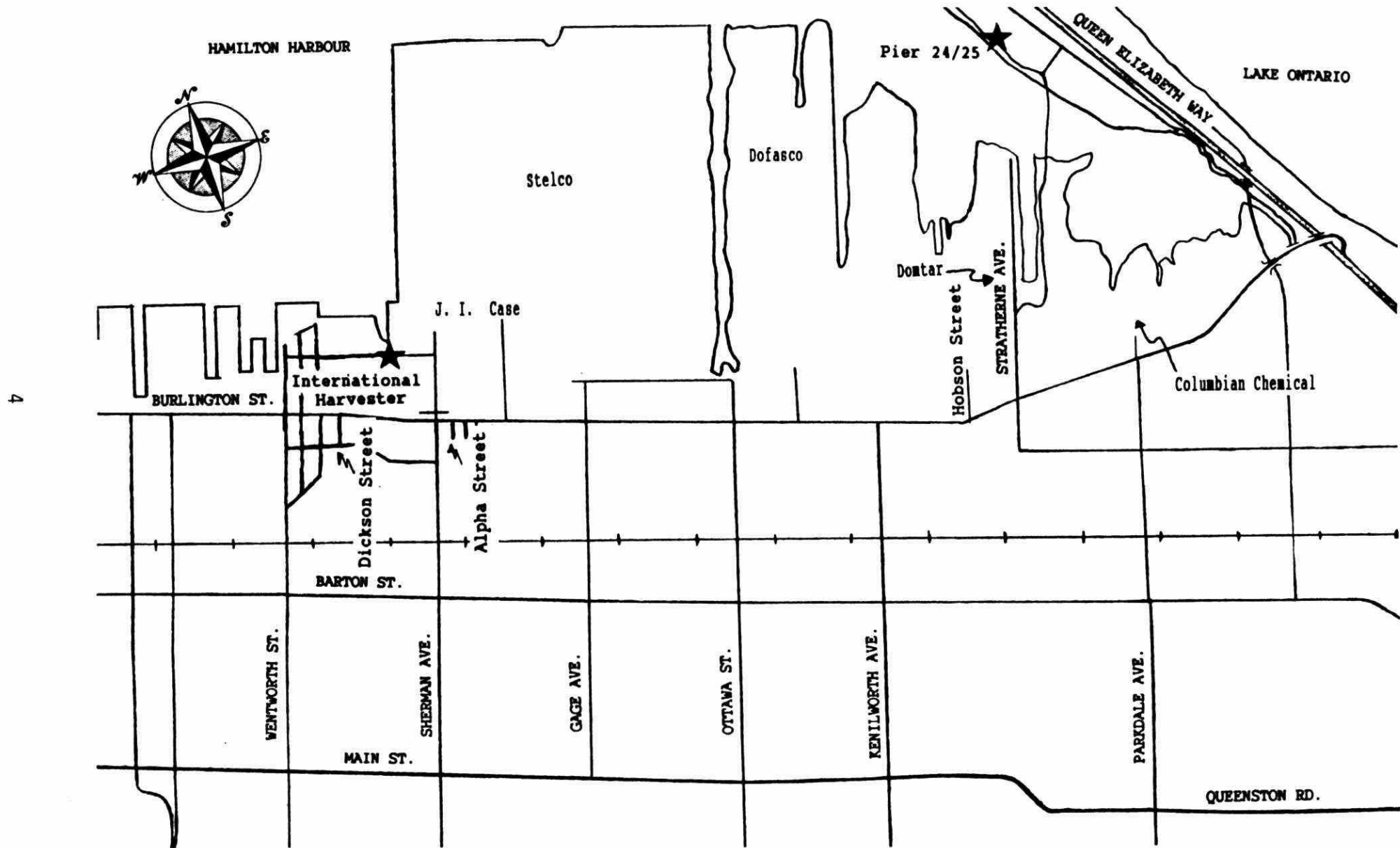
## SOMMAIRE

À la demande de la Région du Centre-Ouest, l'unité mobile de surveillance de l'air n° 1 de la Direction des ressources atmosphériques a procédé, du 6 au 17 octobre 1986, à une étude de la qualité de l'air ambiant dans le centre et dans les quartiers industriels d'Hamilton. Cette étude avait pour objectifs principaux de déterminer la qualité de l'air dans ces zones et, si possible, d'étudier la qualité de l'air au voisinage de plusieurs usines au nord de la rue Burlington, à savoir : l'usine de bitume Domtar (Cassidy Works), l'usine Columbian Chemical et les aciéries Stelco et Dofasco. Les résultats de cette étude devaient également être comparés à ceux d'une étude analogue effectuée à l'automne de 1985.

D'après les données sur la qualité de l'air recueillies lors de l'étude de 1986, les oxydes d'azote, le naphtalène et le soufre total réduit présents dans l'atmosphère pourraient poser certains problèmes environnementaux. D'après les mesures effectuées sous le vent par rapport à l'usine Stelco, la concentration maximale moyenne sur une demi-heure, au sol, est de 0,47 partie par million (ppm) d'oxydes d'azote. La norme de qualité de l'air du Ministère applicable à ce contaminant est de 0,25 ppm. On a détecté, sous le vent par rapport à l'usine de bitume Domtar (Cassidy Works) des concentrations moyennes sur une demi-heure allant jusqu'à 330 microgrammes par mètre cube ( $\mu\text{g}/\text{m}^3$ ) de naphtalène. En avril 1987, le Ministère a adopté une ligne directrice provisoire sur la qualité de l'air qui fixe à  $36 \mu\text{g}/\text{m}^3$  la concentration de naphtalène. On a détecté des concentrations moyennes sur une demi-heure de composés de soufre total réduit atteignant 0,12 ppm sous le vent par rapport à l'usine Domtar, et des concentrations d'environ 0,005 ppm dans l'ensemble de la zone industrielle. Il n'existe aucune ligne directrice du Ministère sur la qualité de l'air relativement aux composés de soufre total réduit libérés par les usines de bitume; cependant, une ligne directrice provisoire fixe à 0,027 ppm la concentration de ces composés provenant des usines de pâte à papier kraft.

On a pu observer une très grande similitude entre les données sur la qualité de l'air de 1985 et celles de 1986. Le naphtalène, les composés de soufre total réduit et les oxydes d'azote se sont avérés d'importants contaminants gazeux lors des deux études. En revanche, la concentration des autres contaminants n'a jamais dépassé ni même frôlé les normes, critères, lignes directrices ou lignes directrices provisoires établis par le Ministère.

General Industrial Area Map - Hamilton



★ - passive monitoring sites

Abbreviations that will be used in this survey report:

ARB	Air Resources Branch
AQM	Air Quality and Meteorology
°C	degrees Celsius
CC(s)	common contaminant(s)
CH <sub>4</sub>	methane
CO	carbon monoxide
GC	gas chromatograph
GLC(s)	ground level concentration(s)
km/hr	kilometre per hour
MAMU	Mobile Air Monitoring Unit
MP	monitoring period
N/A	not applicable
n.a.	not available
n.d.	not detected
NO	nitric oxide
NO <sub>x</sub>	oxides of nitrogen
NO <sub>2</sub>	nitrogen dioxide
O <sub>3</sub>	ozone
ppm	parts per million
SO <sub>2</sub>	sulphur dioxide
THC	total hydrocarbon compounds
TH-M	non-methane hydrocarbons
TRS	total reduced sulphur compounds
ug/m <sup>3</sup>	micrograms per cubic metre
VOC(s)	volatile organic compound(s)

## 1.0 Background and Introduction

In the fall of 1985, Mobile Air Monitoring Units #1 and #2 of the Air Resources Branch undertook an air quality survey in the downtown and industrial sectors of Hamilton. The main aims of this survey were to determine the air quality in these areas and if possible, to investigate the air quality in the vicinity of several industries north of Burlington Street, namely; the Domtar (Cassidy Works) tar plant, Columbian Chemical, and the Stelco and Dofasco steel mills. The results of this survey were released as Ministry reports ARB-219-85-AQM and ARB-84-86-AQM.

As stated in report ARB-219-85-AQM, significant ground level concentrations of total reduced sulphur compounds and volatile organic compounds were detected downwind of Domtar. The maximum half-hour average ground level concentration of total reduced sulphur compounds measured at that time was 0.10 parts per million. From the gas chromatographic analyses of 17 volatile organic compound samples, the total organic concentrations ranged from 127 to 1650 micrograms per cubic metre with the alkane, aromatic and chlorinated fractions accounting for 23, 69 and 5% of these totals respectively. Of the detected volatile organic compounds, the more dominant were benzene, toluene and xylenes with maximum concentrations of 330, 150 and 164 micrograms per cubic metre respectively. Naphthalene was also identified in the samples and although its concentrations appeared to be significant, no amount could be given since the gas chromatographic system was not quantitatively calibrated for this organic compound.

The data presented in report ARB-84-86-AQM outlined the air quality parameters measured in the vicinity of the three other sources, namely: Dofasco was determined to be a source of total reduced sulphur compounds and oxides of nitrogen (maximum half-hour average ground level concentrations being 0.027 and 0.24 parts per million respectively); Stelco as a source of total reduced sulphur compounds, sulphur dioxide and oxides of nitrogen (maximum half-hour average ground level concentrations being 0.087, 0.15 and 0.22 parts per million respectively); whereas low concentrations for the common contaminants were detected downwind of Columbian Chemical. In general, from the analyses of the volatile organic compound samples acquired in the vicinity of these three industries, the total organic concentrations ranged up to 500 micrograms per cubic metre downwind of these industries with the alkane fraction usually uniform and accounting for approximately 40% of the total concentrations and the aromatic fraction being highly variable and accounting for up to 60% of the totals. The more dominant volatile organic compounds were benzene, toluene and xylenes but their individual concentrations were all less than 50 micrograms per cubic metre. Very little chlorinated organics (less than 10 micrograms per cubic metre total) and no naphthalene were detected in any of these samples.

From all of the air quality data acquired during the 1985 fall survey, no applicable Ministry of the Environment Air Quality Standards, Criteria, Guidelines or Provisional Guidelines were exceeded. (Total reduced sulphur exceeded the 0.027 ppm standard for kraft pulp mills, but no standard exists for tar plants.)

During the winter of 1985/86, a considerable amount of research and development work was undertaken on the gas chromatographic systems of the Mobile Air Monitoring Units. In 1985, the field libraries of the gas chromatographic systems contained 120 different volatile organic compounds. In the spring of 1986, they were up-graded to 133 different volatile organic compounds and naphthalene was one of the new entries.

In the spring of 1986, another request was received from the West Central Region to undertake a similar air quality study as was performed in 1985. The objectives of the survey were to compare the air quality results with those of the 1985 study with emphasis being placed on ambient air measurements of naphthalene and total reduced sulphur compounds.



## 2.0 The MAMU and Monitoring Program

Because of other commitments and staffing problems, only MAMU#1 was able to undertake this requested survey.

The most versatile analyzer of MAMU#1 was the dual capillary column gas chromatographic system which was used for the detection, identification and quantification of up to 133 different VOCs. To detect individual VOCs in ambient air down to concentrations of  $1 \text{ ug/m}^3$ , ambient air was drawn through a trace organic preconcentrator unit for a set period of time - usually for 30-minutes. In the trace organic preconcentrator, the organics were adsorbed onto a Carbotrap-Spherocarb cartridge and then thermally desorbed and prefocused onto a nickel loop cooled to  $-195^\circ\text{C}$  with liquid nitrogen. The prefocused organics were then flash vapourized and injected simultaneously onto two 25 metre columns (OV-1, SE-54) where the individual organics were separated and measured by flame ionization detectors. Positive identification of the VOCs was assisted by a computer which compared and correlated the results of the two columns with a library of 133 different VOCs that had been established from prior calibration tests.

The other analytical instruments of MAMU#1 were specific continuous gas analyzers that measured the following common contaminants in ambient air.

Oxides of Nitrogen ( $\text{NO}_x$ )	Nitric Oxide ( $\text{NO}$ )
Nitrogen Dioxide ( $\text{NO}_2$ )	Sulphur Dioxide ( $\text{SO}_2$ )
Total Reduced Sulphur Cpds (TRS)	Carbon Monoxide ( $\text{CO}$ )
Total Hydrocarbon Cpds (THC)	Methane ( $\text{CH}_4$ )
Non-methane Hydrocarbons (TH-M)	Ozone ( $\text{O}_3$ )

MAMU#1 also contained a complete ground-based meteorological station which continuously recorded wind direction and speed, ambient temperature, humidity, solar radiation and barometric pressure data.

A more detailed description of the specific monitoring capabilities of the instruments of MAMU#1 together with the respective detection limits and applicable Ministry of the Environment Air Quality Standards, Criteria, Guidelines and Provisional Guidelines are presented in Tables 1 and 2. Of special note is the  $36 \text{ ug/m}^3$  Provisional Guideline for a maximum half-hour average concentration of naphthalene that was adopted by the Ministry in April of 1987 (Table 2).

The 1986 air quality survey ran from October 6 to October 17 and during this time, active monitoring was conducted on 8 different days. An active monitoring program infers that staff members were on site; all analyzers were scrutinized and if needed,

calibrated; the monitoring unit was moved to the appropriate site(s) downwind or upwind of source(s); and that ambient air monitoring was being undertaken by all instrumentation housed in the monitoring unit. At other times (mainly at night), a passive monitoring program was followed in that the monitoring unit was stationary (usually positioned at either the Harvester or Pier 24/25 sites where external electrical power was available); no staff members were present; and only the continuous gas analyzers and meteorological station were operational.

The data set for this study was composed of 23 different monitoring periods during which times, 122 hours of common contaminant and ground-based meteorological data and 25 half-hour volatile organic compound samples were acquired.

As the survey evolved, it became obvious that the acquired data set could be discussed under the following categories: the air quality data acquired (A) in the vicinity of the Domtar (Cassidy Works) tar plant; (B) in the vicinity of Columbian Chemical; (C) in the vicinity of Dofasco and Stelco; and (D) in the general downtown area of Hamilton (Pier 24/25 site (overnight), Harvester site (overnight), upwind and general sampling work).



### 3.0 RESULTS AND DISCUSSION

#### 3.1 Air Quality in the Vicinity of Domtar

As can be seen from Table 3, active ambient air monitoring in the vicinity of Domtar was conducted on October 6, 7, 14, 16 and 17. Ambient air quality data was acquired during ten different monitoring periods (3 being upwind measurements and 7 being downwind measurements) and approximately 19 hours of CC and meteorological data and 15 VOC samples (3 upwind and 12 downwind) were acquired.

On October 6, the winds were from the WNW at 30 km/hr and gusting to 50 km/hr. The cloud cover was scattered to broken cumulus and the ambient temperature was in the mid-teens.

At noon on October 6, MAMU#1 moved to Strathearne Avenue and was parked adjacent to and directly downwind of Domtar. The unit was just north of the Pier 24/25 branch road on Strathearne Avenue. A strong odour of reduced sulphur compounds (i.e. a rotten egg type of odour) was detected at this site and commencing at 12:46pm, one hour of CC data and one 30-minute VOC sample were acquired. For the common contaminant data (as noted by MP A062 in Tables 4 and 4a), elevated GLCs of CO, THC, TRS and NO<sub>x</sub> were measured. The maximum half-hour average GLCs of these contaminants were 1.2, 2.6, 0.022 and 0.16 ppm respectively. The VOC concentrations were also elevated (Table 5). The total organic concentration was 779 ug/m<sup>3</sup> with the alkane, aromatic and chlorinated alkane fractions comprising 21, 65 and 11% of this total respectively. The more dominant VOCs were the low-boiling alkanes (propane, 2-methylpropane, butane, 2-methylbutane, pentane, 2-methylpentane and hexane) with individual concentrations less than 35 ug/m<sup>3</sup>; the aromatics (benzene, toluene, xylenes and 1,2,4-trimethylbenzene with concentrations of 178, 94, 55 and 9 ug/m<sup>3</sup> respectively); the chlorinated alkane, tetrachloromethane with a concentration of 77 ug/m<sup>3</sup>; indan at 36 ug/m<sup>3</sup>; and naphthalene at 87 ug/m<sup>3</sup>.

As noted in Table 2, the Ministry of the Environment has no applicable Air Quality Standards, Guidelines or Provisional Guidelines for propane, 2-methylpropane, butane, 2-methylbutane, pentane, 2-methylpentane or indan. However there are applicable half-hour Standards for benzene (10,000 ug/m<sup>3</sup>), toluene (2,000 ug/m<sup>3</sup>), xylenes (2,300 ug/m<sup>3</sup>), ethylbenzene (4,000 ug/m<sup>3</sup>) and 1,2,4-trimethylbenzene (100 ug/m<sup>3</sup>); half-hour Guidelines for hexane (35,000 ug/m<sup>3</sup>) and tetrachloromethane (1,800 ug/m<sup>3</sup>); and a half-hour Provisional Guideline for naphthalene (36 ug/m<sup>3</sup>).

At 1:46pm, MAMU#1 moved approximately 75 metres further east onto the Pier 24/25 branch road and was set up near the public weigh scale. The wind speed had decreased slightly. This location was approximately 100 metres downwind of the tar plant and the strong odour of reduced sulphur compounds was still prevalent (MP

A063). Commencing at 1:54pm, 1.5 hours of CC data and two 30-minute VOC samples were acquired (Tables 3 and 5). Again elevated concentrations for the common contaminants were recorded. For CO, THC, TRS and NO<sub>x</sub>, the respective maximum half-hour average GLCs were 1.2, 2.8, 0.019 and 0.11 ppm (Table 4a). As for the two VOC samples, the total organic concentrations were 732 and 300 ug/m<sup>3</sup> (Table 5). On the average, the alkane, aromatic and chlorinated alkane fractions comprised 11% (56 ug/m<sup>3</sup>), 73% (376 ug/m<sup>3</sup>) and 15% (77 ug/m<sup>3</sup>) of these totals. In the first sample, 36 different VOCs were identified and 84% of the total peak area of the resulting chromatograms was accounted for by the field GC library. In the second sample, 26 different VOCs were detected and 77% of the total peak area was identified. The more prominent VOCs detected in both samples were benzene, toluene, xylenes and tetrachloromethane at average concentrations of 154, 68, 39 and 71 ug/m<sup>3</sup> respectively. Only the first VOC sample contained measureable concentrations of indan and naphthalene (at respective concentrations of 41 and 131 ug/m<sup>3</sup>).

After 3pm, MAMU#1 moved upwind of Domtar. Commencing shortly before 4pm, 1 VOC sample and approximately 1 hour of CC data were acquired near the main entrance of the Stelco #2 Rod Mill on Hobson Street (MP A064). No reduced sulphur odours were detected by the staff at this site, however elevated GLCs for the other common contaminants were measured (Table 4a). The maximum half-hour average GLCs for CO, THC, TRS and NO<sub>x</sub> were determined to be 2.3, 2.2, 0.005 and 0.18 ppm respectively. From the analysis of the VOC sample, the total organic concentration was determined to be 240 ug/m<sup>3</sup> with the alkane, aromatic and chlorinated alkane fractions accounting for 47% (113 ug/m<sup>3</sup>), 28% (67 ug/m<sup>3</sup>) and 19% (46 ug/m<sup>3</sup>) of this total respectively (Table 6). A variety of low-boiling alkanes were detected in this sample but the individual concentrations were all less than 26 ug/m<sup>3</sup> (hexane). For the aromatics, a concentration of 34 ug/m<sup>3</sup> was determined for benzene; 16 ug/m<sup>3</sup> for toluene; and 10 ug/m<sup>3</sup> for the xylenes. For the chlorinated alkanes, 38 ug/m<sup>3</sup> of tetrachloromethane and 8 ug/m<sup>3</sup> of 1,1,1-trichloroethane were determined from the sample. For the other VOCs of interest, no indan or naphthalene was detected. During this monitoring period, rush-hour traffic was a problem in downtown Hamilton and the winds were from the southwest and moderate. From windrose analyses and considering the characteristic of these measurements, the main source for these contaminants was deemed to be the vehicular traffic along Burlington Street and the other routes in downtown Hamilton. In other words, although the monitoring unit was upwind of Domtar, it was also downwind of the major traffic routes of Hamilton.

On October 7, the winds were westerly at about 20 km/hr. It was a clear, sunny day and MAMU#1 moved to the Pier 24/25 branch road and set up near the water's edge, approximately 200 metres downwind of Domtar. Monitoring commenced at 9:23am. Some reduced sulphur odours were detected by the staff at this site but after an hour of monitoring (MP A072 - Table 3), it was decided to move the monitoring unit closer to the tar plant where this odour was much more pronounced. No VOC samples were collected at this first site

and as noted in Table 4a, the maximum half-hour average GLC of TRS was 0.014 ppm.

The second monitoring site for October 7 was on Strathearne Avenue adjacent to and downwind of Domtar. This was the same site as MP A062. Commencing at 11:23am (Tables 3 and 5 - MP A073), over 4 hours of CC data and 3 VOC samples were acquired at this second site. The reduced sulphur odour was much stronger and as noted in Table 4a, the maximum half-hour average GLC for TRS was now 0.070 ppm. For the other CCs, the maximum half-hour average GLCs were 0.5 ppm (CO), 3.4 ppm (THC) and 0.11 ppm (NO<sub>x</sub>). The total organic concentrations determined from the 3 VOC samples were 1725, 1149 and 871 ug/m<sup>3</sup> for an average total concentration of 1248 ug/m<sup>3</sup>. On the average, the alkane, aromatic and chlorinated alkane fractions comprised 9% (107 ug/m<sup>3</sup>), 73% (908 ug/m<sup>3</sup>) and 17% (210 ug/m<sup>3</sup>) of these totals. Once again, the more dominant VOCs were benzene, toluene and xylenes at concentrations ranging up to 300, 167 and 127 ug/m<sup>3</sup> respectively; ethylbenzene ranging up to 53 ug/m<sup>3</sup>; indan ranging up to 141 ug/m<sup>3</sup>; naphthalene ranging up to 330 ug/m<sup>3</sup>; and the low-boiling alkanes (propane to hexane) with concentrations ranging up to 53 ug/m<sup>3</sup>.

On October 14, it was overcast and the winds were brisk (gusting to 40 km/hr) and westerly. Shortly before 1:30pm, MAMU#1 was moved to Strathearne Avenue, adjacent to and downwind of Domtar. This was the same site as that utilized during MPs A062 and A073 and the strong odour of reduced sulphur compounds was still prevalent. The gas chromatograph developed mechanical problems at this time and hence only CC data were acquired at this site. As noted by MP A142 in Table 3, 2.9 hours of CC data were measured. The maximum half-hour average GLC for TRS was 0.120 ppm; for CO, 2.8 ppm; for THC, 4.6 ppm; and for NO<sub>x</sub>, 0.14 ppm (Table 4a). The rotten egg odour at this site is clearly reflected by the significant TRS results. The overall average GLC for TRS measured throughout the entire monitoring period was found to be 0.066 ppm (Table 4).

Because of the high TRS results, MAMU#1 moved upwind of Domtar and set up on Hobson Street, just north of Burlington Street. The gas chromatograph was repaired and the winds remained brisk and westerly. No strong odours were perceived and commencing at 5pm, a half-hour VOC sample and approximately 1 hour of CC data were acquired (MP A143). For the CC data (Tables 3 and 4a), the maximum half-hour average GLCs were determined to be 3.5 ppm for CO, 1.6 ppm for THC, nd. for TRS (nd. - not detected meaning that the concentration of TRS in the ambient air was lower than the detection limit of the analyzer. For TRS, this was 0.002 ppm) and 0.08ppm for NO<sub>x</sub>. The results of the analysis of the VOC sample indicated ambient air concentration of VOCs typical of an urban environment. As noted in Table 6, the total organic concentration was 144 ug/m<sup>3</sup> with the alkane, aromatic and chlorinated alkane fractions comprising 51% (74 ug/m<sup>3</sup>), 31% (45 ug/m<sup>3</sup>) and 15% (22 ug/m<sup>3</sup>) of this total respectively. No naphthalene or indan was detected and the more dominant VOCs were the low-boiling alkanes and aromatics. No individual VOC concentrations were greater than 20 ug/m<sup>3</sup>.

On October 16, it was overcast with periods of light rain. The winds were westerly and moderate with gusts up to 30 km/hr.

After the morning work at Pier 24/25, MAMU#1 moved to Strathearne Avenue and set up at the same site as was used during MPs A062, A073 and A142. Again, this site was adjacent to and directly downwind of Domtar and the strong pungent odour of reduced sulphur compounds was prevalent. As noted by MP A164 in Tables 3 and 5, monitoring commenced shortly before 1pm and 3 half-hour VOC samples and approximately 3 hours of CC data were acquired. As listed in Table 4a, elevated GLCs for the common contaminants were measured as the maximum half-hour average GLCs for CO, THC, TRS and NO<sub>x</sub> were found to be 4.6 ppm, 3.0 ppm, 0.034 ppm and 0.13 ppm respectively. From the analyses of the 3 VOC samples, elevated concentrations of VOCs were also measured. The total organic concentrations were 696, 480 and 903 ug/m<sup>3</sup> for an average of 693 ug/m<sup>3</sup>. On the average, the alkane, aromatic and chlorinated alkane fractions comprised 16% (109 ug/m<sup>3</sup>), 78% (541 ug/m<sup>3</sup>) and 4% (28 ug/m<sup>3</sup>) of these totals respectively. The more dominant VOCs were the lower ordered aromatics, naphthalene and indan. As noted in Table 5, the average concentration for benzene was found to be 116 ug/m<sup>3</sup>; for toluene, 72 ug/m<sup>3</sup>; for the xylenes, 65 ug/m<sup>3</sup>; for naphthalene, 168 ug/m<sup>3</sup> (a maximum of 226 ug/m<sup>3</sup> was reported from the last sample); and for indan, 61 ug/m<sup>3</sup> (a maximum of 98 ug/m<sup>3</sup>). Tetrachloromethane and ethylbenzene were detected at concentrations ranging up to 42 ug/m<sup>3</sup>. For the low-boiling alkanes, no individual concentrations were greater than 25 ug/m<sup>3</sup>. Thirty-six to 40 different VOCs were detected in these samples and on the average, 78% of the total peak area of each chromatogram was identified by the field GC libraries.

The winds backed continually throughout the afternoon of October 16 and it started to rain. Because of the wind shift, MAMU#1 moved nearer to the water's edge on the Pier 24/25 road in order to remain downwind of Domtar. Rather than being adjacent to the tar plant, the monitoring unit was now approximately 300 metres downwind. As denoted by MP A165 in Tables 3 and 5, 1.1 hours of CC data and 1 half-hour VOC sample were acquired at this site commencing shortly after 4pm. Again elevated GLCs were measured for the CCs and the VOCs. As listed in Table 4a, the maximum half-hour average GLCs for CO, THC, TRS and NO<sub>x</sub> were found to be 3.8, 2.9, 0.029 and 0.15 ppm respectively. The total organic concentration determined from the VOC sample was 958 ug/m<sup>3</sup> with the alkane fractional concentration being 143 ug/m<sup>3</sup> (15%); the aromatic fraction 714 ug/m<sup>3</sup> (75%); and the chlorinated alkane fraction 89 ug/m<sup>3</sup> (9%). The results of this sample were similar to those obtained during MP A164 as the more dominant VOCs were benzene, detected at a concentration of 137 ug/m<sup>3</sup>; toluene, at 97 ug/m<sup>3</sup>; xylenes, at 85 ug/m<sup>3</sup>; naphthalene, at 215 ug/m<sup>3</sup>; and indan, at 92 ug/m<sup>3</sup>. Tetrachloromethane was detected at 80 ug/m<sup>3</sup> and ethylbenzene at 41 ug/m<sup>3</sup>. Forty different organics were detected in the sample and the field GC library accounted for 83% of the total peak area.



At 5:30pm, MAMU#1 moved upwind of Domtar to a location near the main entrance to the Stelco #2 Rod Mill on Hobson Street. While at this upwind site, 1 VOC sample and 2.2 hours of CC air quality data were acquired (MP A166). Monitoring was conducted during rush-hour traffic and although the monitoring unit was upwind of Domtar, elevated GLCs of CO, THC and NO<sub>x</sub> were measured. As listed in Table 4a, the maximum half-hour average GLC for these 3 CCs were 1.8, 1.7 and 0.20 ppm respectively. No reduced sulphur odours were perceived by the staff and no TRS was detected. As for the VOCs, the total organic concentration determined from the analysis of the VOC sample was 192 ug/m<sup>3</sup> with the alkane, aromatic and chlorinated alkane fractional concentrations being 66% (126 ug/m<sup>3</sup>), 25% (48 ug/m<sup>3</sup>) and 8% (15 ug/m<sup>3</sup>) respectively. No naphthalene or indan was detected and the major fractional group of VOCs were the low-boiling alkanes whose individual concentrations were all less than 35 ug/m<sup>3</sup>. The results of this upwind monitoring period were similar to those reported during MP A064. Upon considering the wind direction and the characteristics of the VOCs at the time of maximum readings at this site, the most plausible source for the somewhat elevated concentrations of the CCs would be vehicular traffic along Burlington Street and the other major traffic routes of downtown Hamilton.

During the morning of October 17, the winds were brisk and northeasterly. It was raining and the sky condition was overcast stratocumulus.

Because of the northeasterly winds, MAMU#1 moved approximately 300 metres southwest and downwind of Domtar to a site on Hobson Street near Burlington Street. The data acquisition system for the common contaminants was inoperative but two half-hour VOC samples were acquired commencing at 11:30am (MP A172, Table 5). These two samples were collected because the strong odour of reduced sulphur compounds was again prevalent in the downwind area of this plant. Elevated concentrations of VOCs were measured as the total organic concentrations were determined to be 656 and 512 ug/m<sup>3</sup>. On the average, the alkane, aromatic and chlorinated alkane fractions accounted for 13% (78 ug/m<sup>3</sup>), 73% (428 ug/m<sup>3</sup>) and 13% (75 ug/m<sup>3</sup>) of these totals. As in the previous sampling, the more dominant VOCs were benzene (an average concentration of 97 ug/m<sup>3</sup>), toluene (68 ug/m<sup>3</sup>), xylenes (46 ug/m<sup>3</sup>), indan (40 ug/m<sup>3</sup>), naphthalene (126 ug/m<sup>3</sup>), 1,1,1-trichloroethane (58 ug/m<sup>3</sup>), and ethylbenzene (17 ug/m<sup>3</sup>). Some low-boiling alkanes were also detected but their individual concentrations were all less than 30 ug/m<sup>3</sup>. Forty-two different VOCs were detected in the first sample and 28 in the second. The field GC library accounted for 83% of the total peak areas on the chromatograms.

From these air quality measurements, the Domtar (Cassidy Works) tar plant on Strathearn Avenue was found to be a source of reduced sulphur compounds, aromatics, some chlorinated alkanes, indan and naphthalene. From the downwind measurements, the maximum half-hour average GLCs for TRS ranged from 0.014 to 0.120 ppm whereas from the upwind measurements, the largest maximum half-hour

average GLC of TRS was only 0.005 ppm (Table 4a). As noted in Table 5, the average total organic concentration determined from 12 downwind VOC samples was 813 ug/m<sup>3</sup> with average alkane, aromatic and chlorinated alkane fractional concentrations accounting for 13% (102 ug/m<sup>3</sup>), 74% (598 ug/m<sup>3</sup>) and 12% (96 ug/m<sup>3</sup>) of these totals respectively. The average concentration of benzene was determined to be 149 ug/m<sup>3</sup> (with a maximum concentration of 300 ug/m<sup>3</sup>); of toluene, 90 ug/m<sup>3</sup> (167 ug/m<sup>3</sup>); of xylenes, 71 ug/m<sup>3</sup> (127 ug/m<sup>3</sup>); of ethylbenzene, 28 ug/m<sup>3</sup> (53 ug/m<sup>3</sup>); of 1,1,1-trichloroethane, 18 ug/m<sup>3</sup> (89 ug/m<sup>3</sup>); of tetrachloromethane, 108 ug/m<sup>3</sup> (500 ug/m<sup>3</sup>); of indan, 70 ug/m<sup>3</sup> (141 ug/m<sup>3</sup>); and of naphthalene, 176 ug/m<sup>3</sup> (330 ug/m<sup>3</sup>). From the 3 upwind VOC samples (Table 6), the average total organic concentration was determined to be 192 ug/m<sup>3</sup> with the average alkane, aromatic and chlorinated alkane fractional concentrations accounting for 54% (104 ug/m<sup>3</sup>), 28% (53 ug/m<sup>3</sup>) and 14% (27 ug/m<sup>3</sup>) of this total respectively. The major VOCs were the low-boiling alkanes with individual concentrations ranging up to 35 ug/m<sup>3</sup>; tetrachloromethane with concentrations up to 38 ug/m<sup>3</sup>; and the benzene, toluene and xylenes with individual concentrations up to 34 ug/m<sup>3</sup>. No naphthalene or indan was detected in the upwind samples.

Elevated concentrations of naphthalene and TRS were detected downwind of Domtar. In April of 1987, the Ministry adopted a half-hour Provisional Guideline for naphthalene of 36 ug/m<sup>3</sup>. During the 1986 survey, up to 330 ug/m<sup>3</sup> of naphthalene for a half-hour average concentration was detected downwind of Domtar. The Ministry has a half-hour Provisional Guideline for TRS (0.027 ppm) for kraft pulp mills although there is no applicable Guideline available for emissions from tar plants. A maximum half-hour average GLC of 0.120 ppm for TRS was measured downwind of the Domtar tar plant.

### 3.2 Air Quality in the Vicinity of Columbian Chemical

As noted in Tables 3 and 7, active ambient air monitoring in the vicinity of Columbian Chemical was conducted on October 8 and 17.

On October 8, the winds were brisk and southwesterly. There was light rain throughout most of the day and the sky condition was generally overcast stratocumulus with the ambient temperature in the mid-teens.

During the early afternoon, MAMU#1 was moved to the north end of Parkdale Avenue and was set up adjacent to and directly downwind of Columbian Chemical. Commencing at 1:45pm, 1.1 hours of CC data and one half-hour VOC sample were acquired (MP A082). No odour was detected at this site and relatively low concentrations were determined for the measured contaminants (Tables 4a and 7). For the CCs, the respective maximum half-hour average GLCs for CO, THC, TRS and NO<sub>x</sub> were 1.1, 1.9, 0.006 and 0.07 ppm. For the VOCs, the total organic concentration was determined to be 217 ug/m<sup>3</sup> with the alkane, aromatic and chlorinated alkane fractions accounting for 67% (146 ug/m<sup>3</sup>), 26% (57 ug/m<sup>3</sup>) and 4% (9 ug/m<sup>3</sup>) of this total respectively. The more dominant VOCs were the low-boiling alkanes (propane to hexane) but their individual concentrations were all less than 35 ug/m<sup>3</sup>. Twenty-seven different VOCs were detected in this sample and the field GC library accounted for 62% of the total peak area of the resulting chromatograms. Naphthalene was detected but its concentration was only 8 ug/m<sup>3</sup>.

After 3pm, MAMU#1 moved to the semi-permanent monitoring site on Pier 24/25. The winds were still southwesterly and brisk. A long-term overnight monitoring program was started at 3:22pm (MP A083) and one VOC sample was acquired between 3:28 and 3:58pm. From the GC analysis, the total VOC concentration was determined to be 275 ug/m<sup>3</sup> (Table 7) with the alkane, aromatic and chlorinated alkane fractions accounting for 45% (125 ug/m<sup>3</sup>), 37% (103 ug/m<sup>3</sup>) and 12% (34 ug/m<sup>3</sup>) of this total respectively. The low-boiling alkanes had concentrations all less than 20 ug/m<sup>3</sup>; the concentrations of benzene, toluene and xylenes were 20, 22 and 21 ug/m<sup>3</sup> respectively; and trichloromethane and naphthalene were detected at concentrations of 25 and 19 ug/m<sup>3</sup> respectively. Although this site was upwind of Columbian Chemical, it was also downwind of the main industrial complex of Hamilton. In particular, it was downwind of Domtar, Stelco/Dofasco and the major traffic routes of downtown Hamilton. This is highlighted from the overnight monitoring program as the maximum one-hour average GLCs for the CCs were found to be 2.1 ppm for CO; 2.4 ppm for THC; 0.012 ppm for TRS; and 0.04 ppm for NO<sub>2</sub> (Table 4a; MP A083). The wind at the time of these maxima was northerly at 34 km/hr which lends credence to the closed circulation cell as described in Report ARB-84-86-AQM.

On October 17, the winds were northeasterly and brisk.

The data acquisition system for the CCs was inoperative and only VOC sampling was undertaken. Shortly after 1pm, MAMU#1 moved to the parking lot of #1817 Burlington Street East. The monitoring unit was approximately 350 metres downwind of Columbian Chemical and commencing at 1:15pm, two half-hour VOC samples were acquired (MP A173; Table 7). The total organic concentrations were 100 and 155  $\mu\text{g}/\text{m}^3$  and on the average, the alkane, aromatic and chlorinated alkane fractions accounted for 58% (74  $\mu\text{g}/\text{m}^3$ ), 33% (42  $\mu\text{g}/\text{m}^3$ ) and 2% (2  $\mu\text{g}/\text{m}^3$ ) of these totals respectively. The only major VOC detected in these samples was naphthalene and it was found at concentrations of 27 and 5  $\mu\text{g}/\text{m}^3$ .

Thus from these two days of air quality monitoring in the vicinity of Columbian Chemical, the results were found to be characteristic of an urban environment with the low-boiling alkanes and CO being the dominant contaminants measured. The winds were brisk during this monitoring and no applicable Ministry of the Environment Air Quality Standards, Guidelines or Provisional Guidelines were exceeded for any of the measured contaminants.



### 3.3 Air Quality in the Vicinity of Dofasco and Stelco

Air quality measurements in the vicinity of Dofasco and Stelco were conducted on October 9 and 10.

On October 9, the winds were generally northerly and brisk. It was a sunny day and the ambient temperature was in the high teens.

At 10am, MAMU#1 moved to the corner of Ottawa and Burlington Streets. This site was directly downwind of Dofasco and commencing at 10:36am, 3 half-hour VOC samples and 2.4 hours of CC data were acquired (MP A092). Good atmospheric dispersion conditions existed and very little odour was detected at this site. For the CCs, the maximum half-hour average GLCs were 1.9 ppm for CO; 1.9 ppm for THC; 0.006 ppm for TRS; and 0.22 ppm for NO<sub>x</sub> (Table 4a). For the VOCs, the total organic concentrations determined from the 3 VOC samples were only 158, 141 and 139 ug/m<sup>3</sup> for an average of 146 ug/m<sup>3</sup> (Table 8). On the average, the alkane, aromatic and chlorinated alkane fractions accounted for 57% (83 ug/m<sup>3</sup>), 34% (49 ug/m<sup>3</sup>) and 5% (8 ug/m<sup>3</sup>) of these totals. An average of 30 different VOCs were detected in these samples but no individual concentration was in excess of 25 ug/m<sup>3</sup>. No indan was detected and only 6 and 8 ug/m<sup>3</sup> of naphthalene was measured in 2 of the 3 samples. From these results, none of the applicable Ministry of the Environment Air Quality Standards, Guidelines or Provisional Guidelines were exceeded for any of these measurements.

Shortly after 1pm, MAMU#1 moved farther west to the corner of Alpha and Burlington Streets. Brisk northerly winds still prevailed and this second monitoring site was directly downwind of Stelco (MP A093; Table 3). Commencing at 1:53pm, 2 half-hour VOC samples and 2 hours of CC data were acquired. Little odour was present but as can be seen from Table 4a, elevated GLCs for CO, THC and NO<sub>x</sub> were detected. The maximum half-hour average GLCs for CO, THC, TRS and NO<sub>x</sub> were 2.4, 2.1, 0.005 and 0.47 ppm respectively. Although not listed in the common contaminant tables, the respective maximum half-hour average GLCs for NO and NO<sub>2</sub> determined during this same monitoring period were 0.30 and 0.16 ppm. For the 2 VOC samples, the total organic concentrations were determined to be 225 and 354 ug/m<sup>3</sup> (Table 8). Of these VOC results, the alkane, aromatic and chlorinated alkane fractions accounted for 52% (152 ug/m<sup>3</sup>), 36% (104 ug/m<sup>3</sup>) and 6% (19 ug/m<sup>3</sup>) of the totals respectively. The more dominant VOCs were the low-boiling alkanes and aromatics but no individual concentrations were in excess of 35 ug/m<sup>3</sup>. Naphthalene was detected at very low concentrations in these two samples (5 and 4 ug/m<sup>3</sup>).

Because of the significant GLCs of NO<sub>x</sub> measured at this site, MAMU#1 immediately moved to the semi-permanent monitoring site at International Harvester. The Harvester site was approximately

500 metres northeast of Alpha and Burlington Streets. This site was not downwind of Stelco as the wind remained northerly and was blowing from across Hamilton Harbour. As noted in Table 3, an overnight monitoring program was started at this site at 4:16pm (MP A094). Although not listed in Table 4a, the maximum half-hour average GLC of  $\text{NO}_x$  measured at this upwind site during the first hour of monitoring was only 0.05 ppm.

On October 10, brisk northeasterly winds were present. The sky condition was clear during the early morning but degraded to broken cumulus by noon. The ambient temperature hovered around  $10^\circ\text{C}$ . This being Friday, the air quality monitoring program was only conducted during the morning hours.

Under the northeasterly winds, MAMU#1 was moved to the corner of Alpha and Burlington Streets shortly before 10am. Commencing at 9:54am, one VOC sample and 0.6 hours of CC data were acquired (MP A102; Table 3). This site was downwind of both Stelco and the J.I. Case Paint plant. A strong paint odour was detected by the ministry staff while at this monitoring site and can be seen from the CC data (Table 4a), elevated GLCs of THC were measured. The maximum half-hour average GLCs for CO, THC, TRS and  $\text{NO}_x$  were 1.0, 2.3, nd. (not detected; i.e. below 0.002 ppm) and 0.16 ppm respectively. From the analysis of the VOC sample, the total organic concentration was determined to be  $243 \text{ ug/m}^3$  with an alkane fractional concentration of  $63 \text{ ug/m}^3$ ; an aromatic fraction of  $173 \text{ ug/m}^3$ ; and a chlorinated alkane fraction of  $6 \text{ ug/m}^3$  (Table 8). Since the aromatics were dominant in the sample, the more prominent compounds were benzene ( $6 \text{ ug/m}^3$ ), toluene ( $16 \text{ ug/m}^3$ ), xylenes ( $89 \text{ ug/m}^3$ ), ethylbenzene ( $23 \text{ ug/m}^3$ ), 1,2,4-trimethylbenzene ( $14 \text{ ug/m}^3$ ) and tert.-butylbenzene ( $20 \text{ ug/m}^3$ ). For the low-boiling alkanes, the most dominant was butane at a concentration of  $10 \text{ ug/m}^3$ .

At 10:40am, MAMU#1 moved further west so as to be downwind of Stelco and not downwind of the Case paint plant. The monitoring site was at the corner of Dickson and Burlington Streets and commencing at 10:46am, another VOC sample and 2 hours of CC data were acquired (MP A103; Table 3). A very weak odour of reduced sulphur compounds was detected at this site and the winds had veered slightly to become easterly at 20 to 30 km/hr. For the CC data (Table 4a), the GLCs of CO and TRS had increased slightly whereas for  $\text{NO}_x$  and THC, they had diminished slightly. The maximum half-hour average GLCs for CO, THC, TRS and  $\text{NO}_x$  were now 1.6, 2.0, 0.010 and 0.09 ppm respectively. For the VOCs, the total organic concentration determined from the VOC sample (A103; Table 8) was now one-half of that determined from the sample acquired at Alpha and Burlington Streets. The total organic concentration was  $105 \text{ ug/m}^3$  and was composed entirely of alkanes ( $37 \text{ ug/m}^3$ ) and aromatics ( $68 \text{ ug/m}^3$ ). The concentrations of benzene, toluene and xylenes were 43, 6 and  $3 \text{ ug/m}^3$  respectively and no low-boiling alkane had a concentration greater than  $5 \text{ ug/m}^3$ . The other major VOCs detected in this sample were naphthalene ( $15 \text{ ug/m}^3$ ) and undecane ( $20 \text{ ug/m}^3$ ).

In summary, from one day of monitoring downwind of Dofasco under good atmospheric dispersion conditions, none of the applicable Ministry of the Environment Air Quality Standards, Guidelines or Provisional Guidelines were exceeded.

From the air quality data acquired in the vicinity of Stelco, the Ministry of the Environment's Air Quality Standard for  $\text{NO}_x$  was exceeded. Downwind point of impingement measurements for this contaminant resulted in a maximum half-hour average GLC of 0.47 ppm whereas upwind measurements resulted in a maximum half-hour average GLC of 0.05 ppm. The Ministry Standard for  $\text{NO}_x$  is 0.25 ppm.

### 3.4 Air Quality of the General Industrial Sector

Throughout this survey, there were several monitoring periods during which a defined source could not be ascertained but in general, the gaseous contaminants monitored by MAMU#1 were deemed to have originated from the industrial complex area of Hamilton. These periods were generally passive long-term (for example: overnight at Pier 24/25 or the Harvester sites) or active short-term monitoring episodes conducted at remote areas throughout the downtown sector of Hamilton. The air quality data acquired during the following monitoring periods fit these criteria: the early morning of October 6 (no MP designation), A064, A065, A074, A083, A094, A143, A153, A155, A162, A166 and A167. Although the data acquired during monitoring periods A064, A083, A143 and A166 were discussed elsewhere in this report, the data will be highlighted in this section in order to maintain continuity.

On October 6, the winds were from the WNW at 30 km/hr gusting to 50 km/hr. This was the first day for this survey and during the morning, all analyzers housed in MAMU#1 were calibrated while the monitoring unit was at the Ministry's Air Quality Equipment shop on Barton Street east of Nash Road. While the common contaminant analyzers were being calibrated, one VOC sample was acquired. As noted in Tables 6 and 9 (Oct 6; 11:47), the analysis of this sample depicted a relatively clean urban environment. The total organic concentration determined from this sample was only 129  $\mu\text{g}/\text{m}^3$  with the alkane, aromatic and chlorinated alkanes comprising 50, 42 and 8% of this total respectively. Only 29 different organics were detected and none of these organics were present at concentrations in excess of 16  $\mu\text{g}/\text{m}^3$ . This sampling site was NOT downwind of any particular industry but rather downwind of the entire industrial sector of Hamilton.

On this same day, upwind measurements of Domtar carried out on Hobson Street and referenced as MP A064 (Tables 3, 4a and 9) were also downwind measurements of the industrial area of Hamilton. The main source of the gaseous contaminants measured during this monitoring period was deemed to be vehicular traffic in downtown Hamilton and the discussion of this data was presented in Section 3.1 of this report.

During the late afternoon of October 6, MAMU#1 moved to the Harvester monitoring site. Overnight monitoring commenced at 5:35pm and 14.5 hours of CC data were acquired (MP A065; Table 3). No VOC sampling was undertaken and as can be seen from Tables 4 and 4a, the overall average and maximum one-hour average GLCs for CO were 0.7 and 1.6 ppm; for THC, 2.5 and 3.9 ppm; for TRS, not detected (or less than 0.002 ppm); and for  $\text{NO}_2$ , 0.04 and 0.06 ppm.

On October 7, the winds were westerly and brisk (up to 35 km/hr). After the active daily monitoring program, MAMU#1 returned to the Harvester site and commenced acquiring overnight data at

4:27pm (MP A074). Again no VOC sampling was carried out and as noted in Table 3, 16.1 hours of CC data were acquired overnight. Again low concentrations were measured for the common contaminants. The overall average and maximum one-hour average GLCs for CO were 0.5 and 0.8 ppm; for THC, 1.3 and 1.4 ppm; for TRS, not detected; and for NO<sub>2</sub>, 0.03 and 0.05 ppm (Tables 4 and 4a).

On October 8, the winds had veered to the northwest and after an active monitoring program downwind of Columbian Chemical, MAMU#1 moved to Pier 24/25 where an overnight monitoring program was carried out (MP A083). Commencing at 3:22pm, one VOC sample and 17.5 hours of CC data were acquired (Table 3). The discussion of the results from this monitoring is presented in Section 3.2. Suffice to say that no measurements exceeded any of the applicable Ministry of the Environment Air Quality Criteria or Guidelines and at the time of maximum readings, the wind was northerly at 34 km/hr.

On October 9, the winds were still northerly and brisk. After the daily monitoring programs in the vicinity of Dofasco and Stelco, the monitoring unit was moved to the Harvester site where an overnight monitoring program commenced at 4:16pm (MP A094). No VOC sampling was carried out and as can be seen from Tables 4 and 4a, the overall average and maximum one-hour average GLCs for CO were determined to be 0.2 and 0.6 ppm; for THC, 1.9 and 2.1 ppm; for TRS, 0.006 and 0.008 ppm; and for NO<sub>2</sub>, 0.03 and 0.06 ppm.

On October 14, the winds were brisk and westerly. After 5pm, MAMU#1 moved to Hobson Street and commenced acquiring air quality data upwind of Domtar (MP A143). One VOC sample and 1.1 hours of CC data were acquired at this site and the discussion of these results was presented in Section 3.1. The air quality data was typical of an urban environment and none of the measurements exceeded any of the applicable Ministry of the Environment Air Quality Criteria or Guidelines (Tables 3, 4a and 9). Because of a power failure, no overnight monitoring was carried out on this date.

On October 15, the winds were northwesterly and brisk. The atmospheric dispersion conditions were good and after the morning calibrations, MAMU#1 commenced monitoring along the Pier 24/25 service road, south of and adjacent to the QEW. Some reduced sulphur odour was present along this road and the monitoring unit was placed in the general area of this odour. One VOC sample and 2.1 hours of CC data were acquired in this area (MP A153; Table 3). From these data, the maximum half-hour average GLCs for CO, THC, TRS and NO<sub>x</sub> were determined to be 0.9, 2.0, 0.011 and 0.13 ppm respectively (Table 4a). From the GC analysis, the total organic concentration was found to be 76 ug/m<sup>3</sup> with an alkane fraction of 26 ug/m<sup>3</sup>; an aromatic fraction of 38 ug/m<sup>3</sup> and a chlorinated alkane fraction of 10 ug/m<sup>3</sup> (Table 9). At the time of maximum odour, the wind direction was from 250 degrees and upon considering the monitoring site, the unit was approximately 800 metres directly downwind of Domtar. However specific source contribution from Domtar of these contaminants could not be determined since no upwind measurements were taken nor was the wind speed and direction



constant for any significant periods of time. Rather, these results were indicative of the emissions from the industrial area of Hamilton.

MAMU#1 moved back to the Pier 24/25 site after 6pm on October 15. Commencing at 6:29pm, a passive overnight monitoring program was carried out (MP A155). No VOC sampling was performed and as noted in Tables 4 and 4a, elevated GLCs for THC and TRS were recorded overnight. From the 14.2 hours of CC data, the overall average and maximum one-hour average GLCs for CO were 0.9 and 1.9 ppm; for THC, 2.3 and 2.7 ppm; for TRS, 0.016 and 0.024 ppm; and NO<sub>2</sub>, 0.03 and 0.04 ppm (Tables 4 and 4a).

During the morning of October 16, the winds were westerly at 25 to 30 km/hr. After the morning calibration work at Pier 24/25, one VOC sample and 1.2 hours of CC data were acquired (MP A162). As listed in Tables 4a and 9, the air quality measurements were all relatively low. The maximum half-hour average GLCs for CO, THC, TRS and NO<sub>x</sub> were 0.9, 1.6, 0.004 and 0.15 ppm respectively. For the VOCs, the total organic concentration was only 104 ug/m<sup>3</sup> with equal contributions from the alkane and aromatic fractions. The monitoring unit was approximately 1 km eastnortheast of the main industrial area of Hamilton and from these results, no discrete source could be ascertained.

During the late afternoon of October 16, MAMU#1 moved upwind of Duntar. At a site on Hobson Street, over 2 hours of CC data and 1 VOC sample were acquired (MP A166). Although this site was upwind of Duntar, it was also downwind of other major industries in the industrial sector of Hamilton and as a result, the discussion of these results is presented in Section 3.1 of this report. The air quality data was typical of an urban environment and none of the measurements exceeded any of the applicable Ministry of the Environment Air Quality Criteria or Guidelines.

During the early evening of October 16, MAMU#1 moved back to Pier 24/25 where another passive overnight monitoring program was carried out. Commencing at 8:21pm, almost 13 hours of CC data were acquired (MP A167) and as can be seen from Tables 4 and 4a, relatively low concentrations were measured. The overall average and maximum one-hour average GLCs for CO were determined to be 0.7 and 1.1 ppm; for THC, 1.7 and 1.9 ppm; for TRS, not detected (below 0.002 ppm); and for NO<sub>2</sub>, 0.07 and 0.09 ppm.

The air quality data acquired during the aforementioned 12 monitoring periods were considered to be characteristic of the environment in the general industrial area of Hamilton. Most of these measurements were taken at night when the ambient temperatures were just above freezing. However, rather than the usual calm weather conditions, the winds remained relatively brisk throughout this entire period. Nevertheless, from the 99 hours of CC data and the 7 half-hour VOC samples, none of the applicable Ministry of the Environment Air Quality Standards, Criteria, Guidelines or Provisional Guidelines were exceeded for any of the measured

contaminants. For the CCs, the maximum one-hour average GLCs of CO ranged from 0.6 to 2.1 ppm; for THC, this range was from 1.4 to 3.9 ppm; for TRS, the range was from less than 0.002 ppm (not detected) to 0.024 ppm; and for NO<sub>2</sub>, the range was from 0.04 to 0.09 ppm (Table 4a). For the VOCs, the average total organic concentration was determined to be 169 ug/m<sup>3</sup> with the alkane, aromatic and chlorinated alkane fractions accounting for approximately 50, 35 and 10% of this total respectively.

#### 4.0 Comparisons and Conclusions

Twenty-three monitoring periods comprised the 1986 air quality survey in the industrial sector of Hamilton. Only one monitoring unit (MAMU #1) of the Air Resources Branch participated in the 1986 survey during which 122 hours of common contaminant (CC) data and 25 volatile organic compound (VOC) samples were acquired.

Seventy different monitoring periods comprised the survey in 1985. Two monitoring units participated and approximately 870 hours of CC data and 100 VOC samples were acquired.

Air quality monitoring in the vicinity of the Domtar (Cassidy Works) tar plant on Strathearn Avenue was conducted on 5 different days in 1986. Fifteen hours of CC data and 12 VOC samples were acquired downwind of this plant (7 monitoring periods) and 4 hours of CC data and 3 VOC samples were acquired upwind of this plant (3 monitoring periods). From these data, this tar plant was found to be a source of total reduced sulphur compounds, aromatics, some chlorinated alkanes, indan and naphthalene. The maximum half-hour average ground level concentrations (GLCs) of total reduced sulphur compounds measured downwind of this plant ranged from 0.014 to 0.120 ppm (parts per million). From the upwind measurements, the maximum half-hour average GLC of TRS was only 0.005 ppm. In 1985, the maximum half-hour average GLC for TRS was 0.10 ppm as acquired during 12 hours of CC data through 6 different monitoring periods. From the analysis of the 12 downwind VOC samples acquired in 1986, the average total organic concentration was found to be approximately 800  $\mu\text{g}/\text{m}^3$ . In 1985, this average concentration was 700  $\mu\text{g}/\text{m}^3$  as analyzed from 17 half-hour VOC samples. In 1986, the alkane, aromatic and chlorinated average fractional concentrations were 102 (13%), 598 (74%) and 96  $\mu\text{g}/\text{m}^3$  (12%) respectively. In 1985, these fractional groups were 161 (23%), 484 (69%), and 32  $\mu\text{g}/\text{m}^3$  (5%) respectively. In 1985, the field GCs could identify up to 120 different VOCs (volatile organic contaminants). In 1986, this number was increased to 133. Thus considering these factors, the concentrations of VOCs detected downwind of this tar plant were very similar during these two years. None of the VOCs were detected in concentrations that exceeded applicable Ministry of the Environment Air Quality Standards, Criteria, Guidelines or Provisional Guidelines. Naphthalene was identified in the VOC samples during the 1985 survey but it was not quantitated. In 1986, the field GC systems were calibrated for this contaminant and half-hour concentrations ranging up to 330  $\mu\text{g}/\text{m}^3$  were detected downwind of this tar plant. In April of 1987, the Ministry of the Environment adopted a half-hour Provisional Guideline of 36  $\mu\text{g}/\text{m}^3$  for naphthalene.

From the two days of monitoring in the vicinity of Columbian Chemical during the 1986 survey, low concentrations were measured and the results were found to be characteristic of an urban environment with the low-boiling alkanes and carbon monoxide being



the dominant contaminants measured. Similar results were found during the 1985 survey. None of the applicable Ministry of the Environment Air Quality Standards, Criteria, Guidelines or Provisional Guidelines were exceeded or even approached by the contaminants measured downwind of this source in 1985 or 1986.

In 1986, 3 VOC samples and 2.4 hours of CC data were acquired downwind of Dofasco. The maximum half-hour average GLCs for CO, THC, TRS and NO<sub>x</sub> were found to be 1.9, 1.9, 0.006 and 0.22 ppm respectively. Low organic concentrations were determined from the 3 VOC samples (an average of only 146 ug/m<sup>3</sup>) and no individual VOC concentrations were in excess of 25 ug/m<sup>3</sup>. In 1985, the maximum half-hour average GLCs of TRS and NO<sub>x</sub> were 0.027 and 0.24 ppm respectively. For the VOCs, the average total organic concentration was 122 ug/m<sup>3</sup> (from 22 samples) with individual VOC concentrations ranging up to 30 ug/m<sup>3</sup>. Once again, similar results were measured during both surveys and none of the applicable Ministry of the Environment Air Quality Standards, Criteria, Guidelines or Provisional Guidelines were exceeded or even approached by the measured contaminants.

In 1986, approximately 5 hours of CC data and 4 half-hour VOC samples were acquired during 3 different monitoring periods downwind of Stelco. From these air quality data, Stelco was found to be a major source of NO<sub>x</sub>. The maximum half-hour average GLCs for CO, THC, TRS and NO<sub>x</sub> were found to be 2.4, 2.1, 0.010 and 0.47 ppm respectively. Immediately following these significant NO<sub>x</sub> readings, monitoring upwind of Stelco resulted in a maximum half-hour average GLC for NO<sub>x</sub> of only 0.005 ppm. Thus the applicable Ministry of the Environment Air Quality Standard for NO<sub>x</sub> (i.e. 0.25 ppm) was exceeded downwind of Stelco. In 1985, the respective maximum half-hour average GLCs for TRS and NO<sub>x</sub> measured downwind of Stelco were 0.087 and 0.22 ppm. For the VOCs detected during the 1986 survey, the average total organic concentration was 232 ug/m<sup>3</sup> with an average alkane, aromatic and chlorinated alkane fractional concentrations of 101 (44%), 112 (48%) and 11 ug/m<sup>3</sup> (5%) respectively. An average of only 30 different VOCs were detected in these samples and none had average concentrations in excess of 30 ug/m<sup>3</sup>. Only 1 VOC sample was acquired downwind of Stelco in 1985. Its total organic concentration was only 117 ug/m<sup>3</sup> with the alkanes accounting for 22% of this total and the aromatics 77%. Apart from NO<sub>x</sub>, no other applicable Ministry of the Environment Air Quality Standard, Criterion, Guideline or Provisional Guideline was exceeded by the contaminants measured downwind of this source.

During the 1986 survey, air quality data acquired during 12 different monitoring periods were considered to be characteristic of the general environment in the industrial area of Hamilton. From the 99 hours of CC data (mostly nighttime monitoring) and the 7 half-hour VOC samples, none of the applicable Ministry of the Environment Air Quality Standards, Criteria, Guidelines or Provisional Guidelines were exceeded for any of the measured contaminants. For the CCs, the maximum one-hour average GLCs of CO ranged from 0.6 to 2.1 ppm; for THC, this range was from 1.4 to 3.9

ppm; for TRS, the range was from less than 0.002 ppm (the analyzer's detection limit) to 0.024 ppm; and for NO<sub>2</sub>, the range was from 0.04 to 0.09 ppm (Table 4a). For the VOCs, the average total organic concentration was determined to be 169 ug/m<sup>3</sup> with the alkane, aromatic and chlorinated alkane fractions accounting for approximately 50, 35 and 10% of this total respectively. In 1985, the air quality data acquired at the Pier 24/25 and Harvester sites were also deemed to be characteristic of the general environment in the industrial area of Hamilton. For these measurements, 13 VOC samples and 381 hours of CC data (as acquired during 17 MPs) were acquired at the Harvester site and 9 VOC samples and 219 hours of CC data (10 MPs) were acquired at the Pier 24/25 site. Nocturnal inversion conditions existed in 1985 and hence more elevated GLCs were measured during that period than in 1986. For example, the maximum one-hour average GLCs for CO, TRS and NO<sub>x</sub> measured at the Harvester site were 4.7, 0.22 and 0.22 ppm respectively and for the Pier 24/25 site, these were 2.2, 0.026 and 0.44 ppm respectively. At the Harvester site in 1985, the average total organic concentration was determined to be 524 ug/m<sup>3</sup> and at Pier 24/25, 75 ug/m<sup>3</sup>.

In conclusion, very little difference was detected between the 1986 and the 1985 data sets. Naphthalene, TRS and NO<sub>x</sub> still remained an environmental concern in the industrial sector of Hamilton.

Appendix.....the DATA

Table 1

## THE INSTRUMENTATION OF MOBILE AIR MONITORING UNIT #1

Instrument	Manufacturer	Analytical Technique	Full Scale Sensitivity
THC, CH <sub>4</sub> , TH-M analyzer	Ingenieur- Produktions-Gruppe Munche (IPM) RS-t	Dual flame ionization	50 ppm THC (as CH <sub>4</sub> )
H <sub>2</sub> S, SO <sub>2</sub> , NO <sub>x</sub> sources	Hartmann & Braun Prufgasgenerator	N/A	N/A
TRS/SO <sub>2</sub> analyzer	Monitor Labs 8850 c/w ML 8770	Fluorescence	0.5 ppm SO <sub>2</sub> 0.5 ppm TRS
NO <sub>x</sub> , NO <sub>2</sub> , NO analyzer	Monitor Labs 8840	Chemi- Luminescence	1.0 ppm NO <sub>x</sub> (as NO <sub>2</sub> )
CO analyzer	Thermo Electron P48	Gas Filter Correlation	100 ppm CO (digital)
O <sub>3</sub> analyzer/ source	Dasibi 1003-AAS	UV Absorption	1.0 ppm O <sub>3</sub> (digital)
Hewlett Packard Data Acquisition System - HP 85 and HP 3497A			
Gas Chromatograph	HP 5880 Dual Capillary Column c/w HP 86 Data Acquisition System	Flame Ion- ization Det.	as set per calibrations

Meteorological Instrumentation

** Wind speed	Lambrecht GmbH	km/hr
** Wind direction	Lambrecht GmbH	degrees
Temperature	Weather Measure (WM) T621	degrees Celsius
Humidity	WM-HM-11P	absolute & %
Barometric pressure	WM-BM70-B242	millibars
Solar Radiation	WM Star Pyranometer	milliwatts/cm <sup>2</sup>

\*\* These instruments are located on top of a 10 metre retractable tower

Table 2

Characteristics of the Organics Measured by the Gas Chromatographic Systems of MAMU #1

All concentrations are in terms of ug/m<sup>3</sup> (micrograms per cubic metre)

	Detection Limits	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
1 ETHANE	0.3					
2 PROPANE	0.2					
3 PROPADIENE	0.3					
4 PROPYNE	0.3					ALLENE
5 CYCLOPROPANE	0.3					METHYL ACETYLENE
6 CHLOROMETHANE	0.3					
7 2-METHYLPROPANE	0.3					
8 CHLOROETHENE	0.3	560 (2)	280 (A)	5000	10000	ISOBUTANE
9 1-BUTENE	0.3					VINYL CHLORIDE; CHLOROETHYLENE
10 2CHLORO2METHYLPROPANE	0.3					
11 1,3-BUTADIENE	0.3					
12 BUTANE	0.2			1900000		*n-BUTANE*
13 1-BUTYNE	0.3					ETHYLACETYLENE
14 CHLOROETHANE	0.3			2600000	3250000	ETHYL CHLORIDE
15 3-METHYL-1-BUTENE	0.3					ISOAMYLENE
16 2-METHYLBUTANE	0.3					ISOPENTANE
17 1-PENTENE	0.3					
18 PENTANE	0.2			1800000	2250000	*N-PENTANE*
19 2-METHYL-1,3-BUTADIENE	0.4					ISOPRENE
20 trans-2-PENTENE	0.2					
21 cis-2-PENTENE	0.2					

Table 2 ctd.

## Characteristics of the Organics Measured by the Gas Chromatographic Systems of MAMU #1

All concentrations are in terms of  $\mu\text{g}/\text{m}^3$  (micrograms per cubic metre)

	Detection Limits	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
22 DICHLOROMETHANE	1.5	100000 (1)	100000 (B)	350000	1740000	METHYLENE CHLORIDE
23 2-METHYL-2-BUTENE	0.3					
24 3-CHLOROPROPENE	0.3					
25 2,2-DIMETHYLBUTANE	0.2					
26 3-METHYL-1-PENTENE	0.2					NEOHEXANE
27 4-METHYL-1-PENTENE	0.2					
28 CYCLOPENTANE	0.2					
29 trans-1,2-DICHLOROETHANE	0.3					
30 2,3-DIMETHYLBUTANE	0.2					
31 2-METHYLPENTANE	0.2					
32 3-METHYLPENTANE	0.2	35000 (2)	12000 (A)	180000	1000000	cis-1,2-DICHLOROETHYLENE; SYM-DICHLOROETHYLENE sec-BUTYL CHLORIDE *n-HEXANE*
33 1-HEXENE	0.3					
34 cis-1,2-DICHLOROETHENE	0.3					
35 2-CHLOROBUTANE	0.6					
36 HEXANE	0.3					
37 TRICHLOROMETHANE	2.2					
38 trans-3-HEXENE	0.3					
39 3-CHLORO-2-METHYLPROPENE	0.3					
40 METHYLCYCLOPENTANE	0.2					ISOBUTENYL CHLORIDE
41 1,2-DICHLOROETHANE	0.2					
42 1,1,1-TRICHLOROETHANE	1.0	350000 (1)	115000 (A)	19000000	2450000	ETHYLENE CHLORIDE METHYL CHLOROFORM

Table 2 ctd.

## Characteristics of the Organics Measured by the Gas Chromatographic Systems of MAMU #1

All concentrations are in terms of ug/m<sup>3</sup> (micrograms per cubic metre)

	Detection Limits	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
43 1-CHLOROBUTANE	0.4					n-BUTYL CHLORIDE
44 BENZENE	0.2	10000 (1)	3300 (A)	30000	75000	
45 TETRACHLOROMETHANE	0.9	1800 (2)	600 (A)	20000	125000	CARBON TETRACHLORIDE
46 CYCLOHEXANE	0.2	300000 (2)	100000 (A)	1050000	1300000	HEXAHYDROBENZENE
47 2,3-DIMETHYLPENTANE	0.3					
48 2-METHYLHEXANE	0.5					ISOHEPTANE
49 CYCLOHEXENE	0.3			1015000		
50 DIBROMOMETHANE	18.4					METHYLENE DIBROMIDE; METHYLENE BROMIDE
51 1,2-DICHLOROPROPANE	0.6					PROPYLENE CHLORIDE
52 3-METHYLHEXANE	0.5					
53 2,3-DICHLOROPROPENE	0.7			5000	50000	2,3-DICHLOROPROPYLENE
54 TRICHLOROETHENE	0.3	85000 (1)	28000 (A)	270000	1080000	TRICHLOROETHYLENE
55 2,2,4-TRIMETHYLPENTANE	0.2					ISOOCTANE
56 1-HEPTENE	0.3					
57 HEPTANE	0.2			1600000	2000000	*n-HEPTANE*
58 1-CHLORO-3-METHYLBUTANE	0.3					
59 trans-2-HEPTENE	0.3					
60 METHYLCYCLOHEXANE	0.2			1600000	2000000	HEXAHYDROTOLUENE
61 4-METHYLCYCLOHEXENE	0.3					
62 2,5-DIMETHYLHEXANE	0.5					
63 1-CHLOROPENTANE	0.4					n-AMYL CHLORIDE; PENTYL CHLORIDE

Table 2 ctd.

## Characteristics of the Organics Measured by the Gas Chromatographic Systems of MAMU #1

All concentrations are in terms of  $\mu\text{g}/\text{m}^3$  (micrograms per cubic metre)

	Detection Limits	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
64 1,1,2-TRICHLOROETHANE	1.1					VINYL TRICHLORIDE
65 TOLUENE	0.2	2000 (1)	2000 (A)	375000	560000	*METHYLBENZENE*; PHENYLMETHANE TRIMETHYLENE CHLORIDE
66 1,3-DICHLOROPROPANE	0.7					
67 2-METHYLHEPTANE	0.2					
68 4-METHYLHEPTANE	0.2					
69 3-METHYLHEPTANE	0.2					
70 1,2-DIBROMOETHANE	2.1					
71 1-OCTENE	0.4	150000 (3)	50000 (A)			ETHYLENE DIBROMIDE; ETHYLENE BROMIDE
72 trans-1,2-DIMETHYLCYCLOHEXANE	0.3					*trans-1,2-DIMETHYLCYCLOHEXANE
73 trans-4-OCTENE	0.3					
74 TETRACHLOROETHENE	0.9	10000 (2)	4000 (A)	335000	1340000	TETRACHLOROETHYLENE; PERCHLOROETHYLENE
75 2-METHYL-1-HEPTENE	0.3					
76 OCTANE	0.3	45400 (3)	15300 (A)	1450000	1800000	*n-OCTANE*
77 trans-2-OCTENE	0.6					
78 cis-1,2-DIMETHYLCYCLOHEXANE	0.2					
79 CHLOROBENZENE	0.4			350000		PHENYL CHLORIDE
80 ETHYLCYCLOHEXANE	0.1					
81 PROPYLCYCLOPENTANE	0.5					
82 1-CHLOROHEXANE	0.5					
83 ETHYLBENZENE	0.3	4000 (1)	4000 (B)	435000	545000	n-HEXYL CHLORIDE
84 m&p-XYLENES	0.3					
		2300 (4)	2300 (A)	435000	655000	*1,3-DIMETHYLBENZENE*



Table 2 ctd.

## Characteristics of the Organics Measured by the Gas Chromatographic Systems of MAMU #1

All concentrations are in terms of ug/m<sup>3</sup> (micrograms per cubic metre)

	Detection Limits	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
85 4-METHYLOCTANE	0.3					
86 2-METHYLOCTANE	0.3					
87 3-METHYLOCTANE	0.3					
88 STYRENE	0.5	400 (1)	400 (A)	215000	425000	*ETHENYLBENZENE*; PHENYLETHYLENE; VINYL BENZENE
89 1,4-DICHLOROBUTANE	0.3					
90 o-XYLENE	0.3	2300 (4)	2300 (A)	435000	655000	*1,2-DIMETHYLBENZENE*
91 1,1,2,2-TETRACHLOROETHANE	2.6					ACETYLENE TETRACHLORIDE
92 1,2,3-TRICHLOROPROPANE	1.3			300000	450000	TRICHLOROHYDRIN
93 1-NONENE	0.7					
94 trans-1,4-DICL-2-BUTENE	0.9					
95 NONANE	0.3			1050000	1300000	*n-NONANE*
96 ISOPROPYLBENZENE	0.3	100 (3)	100 (B)			*1-METHYLETHYL BENZENE*; CUMENE
97 2-CHLOROTOLUENE	0.3					*2-CHLORO-1-METHYLBENZENE*; o-TOLYL CHLORIDE; o-CHLOROTOLUENE
98 3-CHLOROTOLUENE	0.5					*3-CHLORO-1-METHYLBENZENE*; m-TOLYL CHLORIDE; m-CHLOROTOLUENE
99 4-CHLOROTOLUENE	0.5					*4-CHLORO-1-METHYLBENZENE*; p-TOLYL CHLORIDE; p-CHLOROTOLUENE
100 PROPYLBENZENE	0.4					n-PROPYLBENZENE
101 3-ETHYLTOLUENE	0.3					*1-ETHYL-3-METHYLBENZENE*; M-ETHYLTOLUENE
102 4-ETHYLTOLUENE	0.3					*1-ETHYL-4-METHYLBENZENE*; P-ETHYLTOLUENE
103 1,3,5-TRIMETHYLBENZENE	0.4			125000	170000	MESITYLENE
104 2-ETHYLTOLUENE	0.3					*1-ETHYL-2-METHYLBENZENE*; O-ETHYLTOLUENE
105 1,2,4-TRIMETHYLBENZENE	0.4	100 (2)	1000 (A)	125000	170000	PSUEDOCUMENE

Table 2 ctd.

## Characteristics of the Organics Measured by the Gas Chromatographic Systems of MAMU #1

All concentrations are in terms of  $\mu\text{g}/\text{m}^3$  (micrograms per cubic metre)

	Detection Limits	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
106 tert.BUTYLBENZENE	0.3					
107 tert.BUTYLCYCLOHEXANE	0.4					
108 1,3-DICHLOROBENZENE	0.8					
109 1-DECENE	1.3	180000 (3)	60000 (A)			
110 (CHLOROMETHYL)BENZENE	4.3					n-DECYLENE
111 1,5-DICHLOROPENTANE	0.3					alpha-CHLOROTOLUENE; BENZYL CHLORIDE
112 isoBUTYLBENZENE	0.3					
113 DECANE	0.5					
114 sec.BUTYLBENZENE	0.2					*n-DECANE*
115 3-(CHLOROMETHYL)HEPTANE	0.3					*(1-METHYLPROPYL)BENZENE*
116 1,2,3-TRIMETHYLBENZENE	0.4			125000	175000	
117 ISOPROPYL4METHYLBENZENE	0.5					HEMIMELLITENE
118 1,2-DICHLOROBENZENE	0.3					*METHYL(4-METHYLETHYL)BENZENE*; 3-ISOPROPYLTOLUENE; P-CYMENE
119 INDAN	0.5					o-DICHLOROBENZENE
120 N-BUTYLCYCLOHEXANE	0.4					*2,3-DIHYDRO-1H-INDENE*; 2,3-DIHYDROINDENE; HYDRINDENE
121 1,3-DIETHYLBENZENE	0.4					n-BUTYLCYCLOHEXANE; 1-CYCLOHEXYLBUTANE
122 1,4-DIETHYLBENZENE	0.5					m-DIETHYLBENZENE
123 N-BUTYLBENZENE	0.3					p-DIETHYLBENZENE
124 1,2-DIETHYLBENZENE	0.5					n-BUTYLBENZENE
125 T-DECALIN	0.3					o-DIETHYLBENZENE
126 C-DECALIN	0.3					t-DECALIN; BICYCLO[4,4,0]DECANE
						c-DECALIN; BICYCLO[4,4,0]DECANE

Table 2 ctd.

## Characteristics of the Organics Measured by the Gas Chromatographic Systems of MAMU #1

All concentrations are in terms of ug/m<sup>3</sup> (micrograms per cubic metre)

	Detection Limits	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
127 UNDECANE	0.8					*n-UNDECANE*; HENDECANE
128 1235-TETRAMETHYLBENZENE	0.6					ISODURENE
129 1234-TETRAMETHYLBENZENE	0.6					PREHNITENE
130 1234TETRAHYDRONAPHTHALENE	0.6					TETRALIN
131 DIISOPROPYLBENZENE	0.8					*1,4-BIS(1-METHYLETHYL)BENZENE*; ISOPROPYLCUMENE
132 NAPHTHALENE	0.8	36 (3)	22.5 (A)			
133 DODECANE	1.3					*n-DODECANE*

Table 2 ctd.

Characteristics of the Organics Measured by the Gas Chromatographic Systems of MAMU #1

All concentrations are in terms of  $\mu\text{g}/\text{m}^3$  (micrograms per cubic metre)

Detection Limits	Standards, Guidelines or Provisional Guidelines	Criterion	TWA	STEL	Alternate Names
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- 37
- NOTES:
- (1) Standard
  - (2) Guideline
  - (3) Provisional Guideline
  - (4) Standard for the sum of o-, m-, & p- Xylenes
  - (A) Ambient Air Quality Criterion based on a 24-hour average concentration
  - (B) Ambient Air Quality Criterion based on a 1-hour average concentration  
(please note; if the maximum 1-hour average concentration of a contaminant is LESS than the Criterion concentration based on a 24-hour average, then that Criterion has NOT been exceeded.)
  - TWA - Time Weighted Average for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed without adverse effect.
  - STEL - Short Term Exposure Limit - concentration to which workers can be exposed for a short period of time (15 minutes) without adverse effect.
  - \* - Denotes name approved by the International Union of Pure and Applied Chemistry (IUPAC).

Table 2 ctd.

## Characteristics of the Common Contaminants as Measured Continuously by MAMu #1

All concentrations are in terms of ppm (parts per million)

	Detection Limits	Standards, Guidelines or Provisional Guidelines (1/2hr)	Criterion (1hr)	TWA	STEL	Alternate Names
1 SULPHUR DIOXIDE	0.005	(S) 0.300	0.25	2	5	SO <sub>2</sub> SULFUR DIOXIDE
2 TOTAL REDUCED SULPHUR	0.005	(P) 0.027 *	0.027	10	15 **	TRS
3 NITROGEN OXIDES	0.01	(S) 0.25 ***	N/A	-	-	NO <sub>x</sub> OXIDES of NITROGEN
4 NITROGEN DIOXIDE	0.01	N/A	0.20	5	5	NO <sub>2</sub>
5 NITRIC OXIDE	0.01	N/A	N/A	25	35	NO NITROGEN MONOXIDE
6 OZONE	0.01	(S) 0.1	0.08	0.1	0.3	O <sub>3</sub>
7 CARBON MONOXIDE	0.1	(S) 5.0	30.0	50	400	CO

\* As equivalent H<sub>2</sub>S and applicable only for Kraft Pulp Mills  
 TRS may contain any of the following: Hydrogen Sulphide (H<sub>2</sub>S), Methyl Mercaptan (CH<sub>3</sub>SH),  
 Dimethyl Sulphide (C<sub>2</sub>H<sub>6</sub>S) and Dimethyl Disulphide (C<sub>2</sub>H<sub>6</sub>S<sub>2</sub>).

\*\* The TWA and STEL for TRS is expressed solely for Hydrogen Sulphide concentrations

\*\*\* Expressed as NO<sub>2</sub>

S = Standard; G = Guideline; P = Provisional Guideline

Table 3

## HAMILTON 1986 AIR QUALITY SURVEY

Monitoring Periods and Site Information - MAMU#1

Monitoring Period*	Start Time	Duration (hrs)	# GC Samples	Comments	Site Location
A062	06/12:46	1.0	1	Dwnwd Domtar	Strathearne Avenue
A063	06/13:59	1.5	2	Dwnwd Domtar	P 24/25 Rd @ Strathearne
A064	06/15:50	1.2	1	Upwind Domtar	Hobson Street
A065	06/17:35	14.5	-	Overnight	International Harvester
A072	07/09:23	1.2	-	Dwnwd Domtar	P 24/25 Rd (200 metres)
A073	07/11:23	4.3	3	Dwnwd Domtar	Strathearne (100 metres)
A074	07/16:27	16.1	-	Overnight	International Harvester
A082	08/13:30	1.1	1	Dwnwd C. Chem.	Parkdale Avenue
A083	08/15:22	17.5	1	Overnight	Pier 24/25
A092	09/10:51	2.4	3	Dwnwd Dofasco	Ottawa & Burlington Sts.
A093	09/13:53	2.0	2	Dwnwd Stelco	Alpha & Burlington Sts.
A094	09/16:16	16.3	-	Overnight	International Harvester
A102	10/09:58	0.6	1	Dwnwd Stelco	Alpha & Burlington Sts.
A103	10/10:50	2.0	1	Dwnwd Stelco	Dickson & Burlington Sts.
A142	14/13:56	2.9	-	Dwnwd Domtar	Stratherne Ave.
A143	14/17:02	1.1	1	Upwind Domtar	Hobson Street
A153	15/11:22	2.1	1	Dwnwd Hamilton	Pier 24/25
A155	15/18:29	14.2	-	Overnight	Pier 24/25
A162	16/10:05	1.2	1	General A.Q.	Pier 24/25
A164	16/12:51	2.9	3	Dwnwd Domtar	Stratherne Ave.
A165	16/16:14	1.1	1	Dwnwd Domtar	Pier 24/25
A166	16/17:37	2.2	1	Upwind Domtar	Hobson Street
A167	16/20:21	12.7	-	Overnight	Pier 24/25

Twenty-three monitoring periods comprised this survey during which 122 hours of common contaminant data and 25 gas chromatographic samples (one of which is not shown in this Table) were acquired.

\* In the designation of Monitoring Periods Axxxy: 'A' refers to Mobile Air Monitoring Unit #1, 'xx' refers to the day of the month, and 'y' refers to the data acquisition episode of the day.

P 24/25 Rd - refers to Pier 24/25 Road that branches off Strathearne Avenue and runs north to Pier 24/25.



Table 4

## Common Contaminants - Hamilton 1986 Air Quality Survey

Overall Average Ground Level Concentrations (ppm)

Monitoring Period	Start Time	Duration (hrs)	CO	THC	TRS	NO2	Average Wind *
A062	06/12:46	1.0	1.0	2.5	0.015	0.05	2923
A063	06/13:59	1.5	0.9	2.6	0.016	0.05	2919
A064	06/15:50	1.2	1.7	2.1	nd.	0.06	2507
A065	06/17:35	14.5	0.7	2.5	nd.	0.04	****
A072	07/09:23	1.2	0.5	1.7	0.011	0.06	2719
A073	07/11:23	4.3	0.2	2.5	0.037	0.04	2227
A074	07/16:27	16.1	0.5	1.3	nd.	0.03	****
A082	08/13:30	1.1	0.9	1.8	0.006	0.01	2225
A083	08/15:22	17.5	0.8	2.1	0.008	0.02	****
A092	09/15:57	16.8	1.3	1.7	nd.	0.10	0418
A093	09/13:53	2.0	1.8	2.0	nd.	0.14	0116
A094	09/16:16	16.3	0.2	1.9	0.006	0.03	****
A102	10/10:32	0.6	1.0	2.3	nd.	0.06	0719
A103	10/10:50	2.0	1.0	1.9	0.007	0.04	0620
A142	14/13:56	2.9	1.9	3.3	0.066	0.03	2825
A143	14/17:02	1.1	2.8	1.6	nd.	0.03	2626
A153	15/11:22	2.1	0.6	1.9	0.009	0.02	2424
A155	15/18:29	14.2	0.9	2.3	0.016	0.03	****
A162	16/10:05	1.2	0.8	1.5	nd.	0.06	2726
A164	16/12:51	2.9	2.1	2.4	0.018	0.06	2710
A165	16/16:14	1.1	2.5	2.6	0.020	0.06	2414
A166	16/17:37	2.2	1.4	1.6	nd.	0.07	2208
A167	16/20:21	12.7	0.7	1.7	nd.	0.07	****

nd. - not detected; concentration in ambient air less than detection limit of analyzer. The detection limit for the TRS analyzer was 0.002 ppm.

\* - the first two digits refer to the direction (in tens of degrees) from which the wind was blowing and the last two digits refer to the speed in km/hr.

\*\*\*\* - overnight monitoring; average wind not applicable  
Monitoring Period - the 'A' refers to Mobile Air Monitoring Unit #1; the next two digits, the day of the month; and the last digit, the monitoring episode of the day.

Table 4a

## Common Contaminants - Hamilton 1986 Air Quality Survey

Maximum One-Hour Average Ground Level Concentrations (ppm)

Monitoring Period	CO	THC	TRS	NO2	Wind at time of Maximum *
A065	1.6	3.9	nd.	0.06	3230
A074	0.8	1.4	nd.	0.05	2430
A083	2.1	2.4	0.012	0.04	3534
A094	0.6	2.1	0.008	0.06	3525
A155	1.9	2.7	0.024	0.04	3028
A167	1.1	1.9	nd.	0.09	3524

Maximum 1/2-Hour Average Ground Level Concentrations (ppm)

Monitoring Period	CO	THC	TRS	NOx	Wind at time of Maximum *
A062	1.2	2.6	0.022	0.16	3025
A063	1.2	2.8	0.019	0.11	3020
A064	2.3	2.2	0.005	0.18	2511
A072	0.6	1.8	0.014	0.13	2820
A073	0.5	3.4	0.070	0.11	2330
A082	1.1	1.9	0.006	0.07	2227
A092	1.9	1.9	0.006	0.22	0621
A093	2.4	2.1	0.005	0.47	3522
A102	1.0	2.3	nd.	0.16	0721
A103	1.6	2.0	0.010	0.09	0926
A142	2.7	4.6	0.120	0.14	2928
A143	3.5	1.6	nd.	0.08	2727
A153	0.9	2.0	0.011	0.13	2536
A162	0.9	1.6	0.004	0.15	2830
A164	4.6	3.0	0.034	0.13	2914
A165	3.8	2.9	0.029	0.15	2517
A166	1.8	1.7	nd.	0.20	2408

nd. - not detected; concentration in ambient air less than detection limit of analyzer. The detection limit for the TRS analyzer was 0.002 ppm.

\* - the first two digits refer to the direction (in tens of degrees) from which the wind was blowing and the last two digits refer to the speed in km/hr.

Monitoring Period - the 'A' refers to Mobile Air Monitoring Unit #1; the next two digits, the day of the month; and the last digit, the monitoring episode of the day.

Table 5

Hamilton 1986 Air Quality Survey - VOC data acquired downwind of Dometar

all concentration are in ug/m3 (micrograms per cubic metre)

MONITORING PERIOD	A062	A063	A063	A073	A073	A073	A164	A164	A164	A165	A172	A172	Average	Maximum
Sampling End Time	OCT 6 13:16	OCT 6 14:24	OCT 6 15:28	OCT 7 11:50	OCT 7 14:22	OCT 7 15:31	OCT 16 13:16	OCT 16 14:18	OCT 16 15:18	OCT 16 16:43	OCT 17 11:59	OCT 17 12:45		
1 ETHANE														
2 PROPANE	14.7	5.4	3.4	10.1	16.1	6.9	21.1	21.0	22.0	13.2	28.6	11.3	14.5	28.6
3 PROPADIENE														
4 PROPYNE														
5 CYCLOPROPANE														
6 CHLOROMETHANE														
7 2-METHYLPROPANE	7.8			9.4	2.5	2.3	4.5	7.0	3.5	2.4	6.0	1.7	4.7	9.4
8 CHLOROETHENE														
9 1-BUTENE														
10 2CHLORO2METHYLPROPANE														
11 1,3-BUTADIENE														
12 BUTANE	30.3	4.1	2.8	53.3	13.2	14.9	24.2	18.1	20.0	12.9	20.3	8.1	18.5	53.3
13 1-BUTYNE														
14 CHLOROETHANE														
15 3-METHYL-1-BUTENE														
16 2-METHYLBUTANE	11.7	3.3	2.1	24.6	5.8	5.8	13.1	8.3	8.7	7.3	9.4	3.9	8.6	24.6
17 1-PENTENE														
18 PENTANE	13.5	2.9	1.5	16.6	3.3	3.4	10.0	5.5	6.0	5.7	7.2	2.9	6.5	16.6
19 2-METHYL-1,3-BUTADIENE														
20 TRANS-2-PENTENE	1.3			2.1			1.1						1.5	2.1
21 CIS-2-PENTENE														
22 DICHLOROMETHANE														
23 2-METHYL-2-BUTENE														
24 3-CHLOROPROPENE														
25 2,2-DIMETHYLBUTANE														
26 4-METHYL-1-PENTENE														

Table 5

Hamilton 1986 Air Quality Survey - VOC data acquired downwind of Domtar

all concentration are in ug/m3 (micrograms per cubic metre)

MONITORING PERIOD		A062	A063	A063	A073	A073	A073	A164	A164	A164	A165	A172	A172	Average	Maximum
Sampling End Time		OCT 6 13:16	OCT 6 14:24	OCT 6 15:28	OCT 7 11:50	OCT 7 14:22	OCT 7 15:31	OCT 16 13:16	OCT 16 14:18	OCT 16 15:18	OCT 16 16:43	OCT 17 11:59	OCT 17 12:45		
27	3-METHYL-1-PENTENE														
28	CYCLOPENTANE	1.2			1.5			1.2	1.0	1.3	1.2	1.1		1.2	1.5
29	TRANS1,2-DICHLOROETHANE	6.0	4.1	1.1	7.7	2.2	2.8	5.9	3.4	4.1	5.9	3.7	1.8	4.1	7.7
30	2,3-DIMETHYLBUTANE	2.0	1.9		1.9		1.3	1.3		1.1	2.0			1.7	2.0
31	2-METHYLPENTANE	13.5	9.4	2.6	11.3	5.0	7.7	8.6	4.0	6.1	12.1	4.1	1.8	7.2	13.5
32	3-METHYLPENTANE	10.5	10.2	2.7	8.7	5.2	10.1	7.5	3.1	5.4	12.4	2.9	1.2	6.7	12.4
33	1-HEXENE														
34	CIS-1,2-DICHLOROETHENE														
35	2-CHLOROBUTANE														
36	HEXANE	21.7	18.4	4.5	15.6	9.8	17.5	15.2	5.1	9.8	24.7	5.0	2.2	12.5	24.7
37	TRICHLOROMETHANE														
38	TRANS-3-HEXENE														
39	3-CHLORO-2-METHYLPROPENE														
40	METHYLCYCLOPENTANE	4.7	2.9		4.5	1.8	2.6		1.8	2.5	4.1	1.8		3.0	4.7
41	1,2-DICHLOROETHANE														
42	1,1,1-TRICHLOROETHANE	5.5	6.4	4.8	16.0	18.6	13.0	8.9	9.2	7.9	9.1	89.4	26.2	17.9	89.4
43	1-CHLOROBUTANE														
44	BENZENE	178.1	193.6	114.0	300.0	200.0	120.0	113.4	73.9	159.5	136.7	93.2	101.3	148.6	300.0
45	TETRACHLOROMETHANE	77.2	93.5	49.0	500.0		80.9	42.2	14.4		80.0	33.0		107.8	500.0
46	CYCLOHEXANE	2.6	3.1	2.4			2.5	2.3		3.6	2.8	2.1		2.7	3.6
47	2,3-DIMETHYLPENTANE	7.1	3.9	1.6		2.1	2.9		1.7	2.7	5.0	2.0	1.0	3.0	7.1
48	2-METHYLHEXANE	8.0	4.4	1.8					1.9	3.0	5.6	2.2	1.1	3.5	8.0
49	CYCLOHEXENE														
50	DIBROMOMETHANE														
51	3-METHYLHEXANE	6.3	3.6	1.3					1.4	2.1	4.8	1.6		3.0	6.3
52	1,2-DICHLOROPROPANE														
53	2,3-DICHLOROPROPENE														

Table 5

Hamilton 1986 Air Quality Survey - VOC data acquired downwind of Dometar

all concentration are in ug/m3 (micrograms per cubic metre)

MONITORING PERIOD	A062	A063	A063	A073	A073	A073	A164	A164	A164	A165	A172	A172	Average	Maximum
Sampling End Time	OCT 6 13:16	OCT 6 14:24	OCT 6 15:28	OCT 7 11:50	OCT 7 14:22	OCT 7 15:31	OCT 16 13:16	OCT 16 14:18	OCT 16 15:18	OCT 16 16:43	OCT 17 11:59	OCT 17 12:45		
54 TRICHLOROETHENE														
55 2,2,4-TRIMETHYLPENTANE	1.0			1.2										
56 1-HEPTENE										1.2	1.0		1.1	1.2
57 HEPTANE	6.3	2.8	1.2		1.2	1.8	2.0	1.1	1.6	3.7	1.6		2.3	6.3
58 1-CHLORO-3-METHYLBUTANE														
59 TRANS-2-HEPTENE														
60 METHYLCYCLOHEXANE														
61 4-METHYLCYCLOHEXENE														
62 2,5-DIMETHYLHEXANE														
63 1-CHLOROPENTANE														
64 1,1,2-TRICHLOROETHANE														
65 TOLUENE	93.6	89.0	46.9	166.9	152.7	85.5	74.0	41.6	101.2	97.0	67.6	68.0	90.3	166.9
66 1,3-DICHLOROPROPANE														
67 2-METHYLHEPTANE							1.0		1.0	1.6			1.2	1.6
68 4-METHYLHEPTANE														
69 3-METHYLHEPTANE		1.5			1.2	1.2	1.5		1.4	2.7	1.1		1.5	2.7
70 1,2-DIBROMOETHANE														
71 1-OCTENE														
72 TRANS12DIMETHYLCYCLOHEXANE														
73 TRANS-4-OCTENE														
74 TETRACHLOROETHENE							3.7	2.4	2.1		2.8		2.7	3.7
75 2-METHYL-1-HEPTENE														
76 OCTANE		1.5			1.3	1.1	1.7		1.5	2.9	1.1	1.0	1.5	2.9
77 2-OCTENE														
78 CIS12DIMETHYLCYCLOHEXANE														
79 CHLOROBENZENE														
80 ETHYLCYCLOHEXANE														

Table 5

Hamilton 1986 Air Quality Survey - VOC data acquired downwind of Domtar

all concentration are in ug/m3 (micrograms per cubic metre)

MONITORING PERIOD	A062	A063	A063	A073	A073	A073	A164	A164	A164	A165	A172	A172	Average	Maximum
	OCT 6	OCT 6	OCT 6	OCT 7	OCT 7	OCT 7	OCT 16	OCT 16	OCT 16	OCT 16	OCT 17	OCT 17		
Sampling End Time	13:16	14:24	15:28	11:50	14:22	15:31	13:16	14:18	15:18	16:43	11:59	12:45		
81 PROPYLCYCLOPENTANE														
82 1-CHLOROHEXANE														
83 ETHYLBENZENE	17.2	15.8	9.2	51.0	52.9	41.5	22.4	14.6	40.4	41.2	17.8	16.5	28.4	52.9
84 M&P-XYLENES	43.0	34.5	26.1	79.4	95.9	98.8	54.6	28.8	65.0	65.6	34.3	35.5	55.1	98.8
85 4-METHYLOCTANE														
86 2-METHYLOCTANE														
87 STYRENE	6.7	8.7	4.8		16.2	8.6	9.3	6.9	13.1	14.4	6.9	10.1	9.6	16.2
88 3-METHYLOCTANE	7.0			16.9	15.4	8.7			13.2				12.2	16.9
89 1,4-DICHLOROBUTANE														
90 O-XYLENE	12.3	9.5	7.0	23.0	26.4	28.5	15.9	9.6	20.8	19.1	10.0	11.4	16.1	28.5
91 1,1,2,2-TETRACHLOROETHANE														
92 1,2,3-TRICHLOROPROPANE														
93 1-NONENE														
94 TRANS-1,4-DICHLOROBUTENE														
95 NONANE	1.8	1.4		1.8	1.4	1.5	2.3	1.9	2.6	4.2	1.8	1.4	2.0	4.2
96 ISOPROPYLBENZENE	1.6	1.1		2.3	2.6	1.5	1.5	1.0	3.0	3.0	1.1	1.1	1.8	3.0
97 2-CHLOROTOLUENE														
98 3-CHLOROTOLUENE														
99 N-PROPYLBENZENE														
100 4-CHLOROTOLUENE		1.0	1.0	2.4	1.7	1.2	1.8	1.1	2.0	2.1		1.1	1.5	2.4
101 3-ETHYLTOLUENE	8.9	3.6	2.0	8.0	7.8	4.6	5.8	3.3	8.5	7.8	7.5	4.0	6.0	8.9
102 4-ETHYLTOLUENE	2.8										2.5		2.7	2.8
103 1,3,5-TRIMETHYLBENZENE	6.1										6.5		6.3	6.5
104 2-ETHYLTOLUENE														
105 1,2,4-TRIMETHYLBENZENE	8.9							2.3			9.1		6.8	9.1
106 tert-BUTYLBENZENE	3.4	9.2	3.8	24.0	22.4	13.8	12.0	7.8	21.3	20.5	4.5	10.4	12.8	24.0
107 t-BUTYLCYCLOHEXANE														



Table 5

Hamilton 1986 Air Quality Survey - VOC data acquired downwind of Domtar

all concentration are in ug/m3 (micrograms per cubic metre)

MONITORING PERIOD	A062	A063	A063	A073	A073	A073	A164	A164	A164	A165	A172	A172	Average	Maximum
	OCT 6	OCT 6	OCT 6	OCT 7	OCT 7	OCT 7	OCT 16	OCT 16	OCT 16	OCT 16	OCT 17	OCT 17		
Sampling End Time	13:16	14:24	15:28	11:50	14:22	15:31	13:16	14:18	15:18	16:43	11:59	12:45		
108 1,3-DICHLOROBENZENE														
109 1-DECENE														
110 (CHLOROMETHYL)BENZENE														
111 1,5-DICHLOROPENTANE														
112 IISOBUTYLBENZENE														
113 DECANE	2.7	2.7	1.7	2.2	2.2	2.7	3.5	4.1	4.2	6.8	3.6	2.3	3.2	6.8
114 secBUTYLBENZENE														
115 3-(CHLOROMETHYL)HEPTANE														
116 1,2,3-TRIMETHYLBENZENE	3.5					3.6					3.2		3.4	3.6
117 IISOPROPYL4METHYLBENZENE														
118 1,2-DICHLOROBENZENE														
119 INDAN	35.7	40.8		141.3	129.9	67.1	49.6	35.9	98.4	92.1	38.8	40.9	70.0	141.3
120 N-BUTYLCYCLOHEXANE														
121 1,3-DIETHYLBENZENE														
122 1,4-DIETHYLBENZENE														
123 N-BUTYLBENZENE														
124 1,2-DIETHYLBENZENE														
125 T-DECALIN														
126 C-DECALIN														
127 UNDECANE	5.0	3.0	1.5	2.8	2.3	2.9	3.0	5.5	4.3	6.3	8.0	2.5	3.9	8.0
128 1235-TETRAMETHYLBENZENE	1.0	1.0				1.4	1.4	1.0	1.5	1.6	1.1		1.2	1.6
129 1234-TETRAMETHYLBENZENE														
130 1234-TETRAHYDRONAPHTHALENE														
131 DIISOPROPYLBENZENE														
132 NAPHTHALENE	86.6	130.6		217.0	330.0	200.0	148.5	129.1	226.1	215.0	108.7	142.5	175.8	330.0
133 DODECANE		2.9		1.3				1.6	1.0	1.5	1.6		1.6	2.9

Table 5

Hamilton 1986 Air Quality Survey - VOC data acquired downwind of Dometar

all concentration are in ug/m3 (micrograms per cubic metre)

MONITORING PERIOD	A062	A063	A063	A073	A073	A073	A164	A164	A164	A165	A172	A172		
Sampling End Time	OCT 6	OCT 6	OCT 6	OCT 7	OCT 7	OCT 7	OCT 16	OCT 16	OCT 16	OCT 16	OCT 17	OCT 17	Average	Maximum
	13:16	14:24	15:28	11:50	14:22	15:31	13:16	14:18	15:18	16:43	11:59	12:45		
Total Compounds Identified	41	36	26	32	31	36	36	36	40	40	42	28	35	42
Total # of Peaks	126	83	94	127	98	94	119	99	106	121	94	78	103	127
Total Area of Peaks	25018	22972	208044	45232	41097	139618	24864	16493	31347	31272	18450	17350	51813	208044
Area of Identified Peaks	19382	19359	159917	33100	24666	74044	18727	12823	25812	25847	15352	14418	36954	159917
Area % Identified Peaks	77	84	77	73	60	53	75	78	82	83	83	83	76	84
Total Organic Conc. ug/m3	778.5	731.5	300.2	1724.7	1149.1	870.6	695.8	480.3	903.2	957.8	655.7	513.1	813.4	1724.7
Alkanes ug/m3	165.6	84.5	28.4	162.5	74.1	85.6	122.6	93.0	110.4	143.1	110.6	43.8	102.0	165.6
Cycloalkanes ug/m3	8.5	6.0	2.4	6.0	1.8	5.0	3.5	2.8	7.3	8.1	5.0	0.0	4.7	8.5
Alkenes ug/m3	1.3	0.0	0.0	2.1	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.4	2.1
Cycloalkenes ug/m3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkynes ug/m3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aromatics ug/m3	509.3	537.4	213.6	1012.8	1036.7	674.9	508.4	355.8	758.8	713.7	412.8	441.8	598.0	1036.7
Chlorinated alkanes ug/m3	82.7	100.0	53.8	516.0	18.6	93.9	51.1	23.7	7.9	89.1	122.5	26.2	98.8	516.0
Chlorinated alkenes ug/m3	6.0	4.1	1.1	7.7	2.2	2.8	9.6	5.8	6.2	5.9	6.6	1.8	5.0	9.6
Chlorinated aromatics ug/m3	0.0	1.0	1.0	2.4	1.7	1.2	1.8	1.1	2.0	2.1	0.0	1.1	1.3	2.4

Table 6

## Hamilton 1986 Air Quality Survey

VOC data acquired upwind of Dometar

General

MONITORING PERIOD	A064	A143	A166		n/a	A154	
	OCT 6	OCT 14	OCT 16		OCT 6	OCT 15	
Sampling End Time	16:29	17:34	18:10	Average	11:47	16:20	Average
1 ETHANE							
2 PROPANE	5.2	5.9	23.0	11.4	9.4	9.9	9.6
3 PROPADIENE							
4 PROPYNE							
5 CYCLOPROPANE							
6 CHLOROMETHANE							
7 2-METHYLPROPANE	1.2	1.4	7.3	3.3	3.2	6.9	5.1
8 CHLOROETHENE							
9 1-BUTENE							
10 2CHLORO2METHYLPROPANE							
11 1,3-BUTADIENE							
12 BUTANE	6.1	5.5	35.2	15.6	15.3	15.0	15.2
13 1-BUTYNE							
14 CHLOROETHANE							
15 3-METHYL-1-BUTENE							
16 2-METHYLBUTANE	5.4	3.5	12.1	7.0	5.0	4.6	4.8
17 1-PENTENE							
18 PENTANE	4.9	2.7	7.6	5.1	3.6	2.9	3.3
19 2-METHYL-1,3-BUTADIENE							
20 TRANS-2-PENTENE							
21 CIS-2-PENTENE							
22 DICHLOROMETHANE							
23 2-METHYL-2-BUTENE							
24 3-CHLOROPROPENE							
25 2,2-DIMETHYLBUTANE							
26 4-METHYL-1-PENTENE							
27 3-METHYL-1-PENTENE							
28 CYCLOPENTANE	1.4			1.4			
29 TRANS12DICHOROETHANE	7.2	2.9	4.4	4.8	2.0		2.0
30 2,3-DIMETHYLBUTANE	2.4	1.2	1.5	1.7			
31 2-METHYLPENTANE	14.2	7.1	5.7	9.0	2.2	1.3	1.7
32 3-METHYLPENTANE	15.6	7.0	4.2	8.9	2.1		2.1
33 1-HEXENE							
34 CIS-1,2-DICHLOROETHENE							
35 2-CHLOROBUTANE							
36 HEXANE	26.3	13.2	6.8	15.4	2.6	1.3	1.9
37 TRICHLOROMETHANE							
38 TRANS-3-HEXENE							
39 3-CHLORO-2-METHYLPROPENE							
40 METHYLCYCLOPENTANE	4.6	2.2	2.0	2.9	1.0		1.0
41 1,2-DICHLOROETHANE							
42 1,1,1-TRICHLOROETHANE	8.1	11.5	5.7	8.4	9.9	11.0	10.4
43 1-CHLOROBUTANE							
44 BENZENE	34.0	7.6	5.8	15.8	15.1	4.2	9.7
45 TETRACHLOROMETHANE	37.6	10.3	8.8	18.9			

Table 6

## Hamilton 1986 Air Quality Survey

VOC data acquired upwind of Domtar

General

MONITORING PERIOD	A064	A143	A166		n/a	A154	
Sampling End Time	OCT 6 16:29	OCT 14 17:34	OCT 16 18:10	Average	OCT 6 11:47	OCT 15 16:20	Average
46 CYCLOHEXANE	1.1			1.1			
47 2,3-DIMETHYLPENTANE	6.9	3.7	3.0	4.5	1.3		1.3
48 2-METHYLHEXANE	7.9	4.2	3.4	5.2	1.5		1.5
49 CYCLOHEXENE							
50 DIBROMOMETHANE							
51 3-METHYLHEXANE	6.3	3.5	2.5	4.1	1.1		1.1
52 1,2-DICHLOROPROPANE							
53 2,3-DICHLOROPROPENE							
54 TRICHLOROETHENE							
55 2,2,4-TRIMETHYLPENTANE			1.4	1.4			
56 1-HEPTENE							
57 HEPTANE	4.6	2.8	2.2	3.2	1.2		1.2
58 1-CHLORO-3-METHYLBUTANE							
59 TRANS-2-HEPTENE							
60 METHYLCYCLOHEXANE							
61 4-METHYLCYCLOHEXENE							
62 2,5-DIMETHYLHEXANE							
63 1-CHLOROPENTANE							
64 1,1,2-TRICHLOROETHANE							
65 TOLUENE	15.9	8.7	11.4	12.0	14.0	2.4	8.2
66 1,3-DICHLOROPROPANE							
67 2-METHYLHEPTANE			1.3	1.3			
68 4-METHYLHEPTANE							
69 3-METHYLHEPTANE	1.6	1.7	1.9	1.7			
70 1,2-DIBROMOETHANE							
71 1-OCTENE							
72 TRANS12DIMETHYLCYCLOHEXANE							
73 TRANS-4-OCTENE							
74 TETRACHLOROETHENE							
75 2-METHYL-1-HEPTENE							
76 OCTANE	1.0	1.8	2.4	1.8			
77 2-OCTENE							
78 CIS12DIMETHYLCYCLOHEXANE							
79 CHLOROBENZENE							
80 ETHYLCYCLOHEXANE							
81 PROPYLCYCLOPENTANE							
82 1-CHLOROHEXANE							
83 ETHYLBENZENE		4.6	5.5	5.0		1.0	1.0
84 M&P-XYLENES	7.2	15.1	17.4	13.2	6.3	3.5	4.9
85 4-METHYLOCTANE							
86 2-METHYLOCTANE							
87 STYRENE							
88 3METHYLOCTANE							
89 1,4-DICHLOROBUTANE							
90 O-XYLENE	2.3	3.9	5.1	3.8	2.4	1.3	1.9

Table 6

## Hamilton 1986 Air Quality Survey

VOC data acquired upwind of Domtar

General

MONITORING PERIOD	A064	A143	A166		n/a	A154	
Sampling End Time	OCT 6 16:29	OCT 14 17:34	OCT 16 18:10	Average	OCT 6 11:47	OCT 15 16:20	Average
91 1,1,2,2-TETRACHLOROETHANE							
92 1,2,3-TRICHLOROPROPANE							
93 1-NONENE							
94 TRANS14DICHLOBUTENE							
95 NONANE		1.4	1.4	1.4	2.4	1.0	1.7
96 ISOPROPYLBENZENE							
97 2-CHLOROTOLUENE							
98 3-CHLOROTOLUENE							
99 N-PROPYLBENZENE							
100 4-CHLOROTOLUENE							
101 3-ETHYLTOLUENE	1.3		1.4	1.4	1.9		1.9
102 4-ETHYLTOLUENE							
103 1,3,5-TRIMETHYLBENZENE	1.0			1.0	1.9		1.9
104 2-ETHYLTOLUENE							
105 1,2,4-TRIMETHYLBENZENE	2.7	2.1		2.4	3.9		3.9
106 tert-BUTYLBENZENE	1.5	2.7	1.0	1.7	5.0	1.0	3.0
107 tBUTYLCYCLOHEXANE							
108 1,3-DICHLOROBENZENE							
109 1-DECENE							
110 (CHLOROMETHYL)BENZENE							
111 1,5-DICHLOROPENTANE							
112 ISOBUTYLBENZENE							
113 DECANE	1.2	1.9		1.5	6.8		6.8
114 secBUTYLBENZENE							
115 3-(CHLOROMETHYL)HEPTANE							
116 1,2,3-TRIMETHYLBENZENE	1.0			1.0	1.9		1.9
117 ISOPROPYL4METHYLBENZENE							
118 1,2-DICHLOROBENZENE							
119 INDAN							
120 N-BUTYLCYCLOHEXANE							
121 1,3-DIETHYLBENZENE							
122 1,4-DIETHYLBENZENE							
123 N-BUTYLBENZENE							
124 1,2-DIETHYLBENZENE							
125 T-DECALIN							
126 C-DECALIN							
127 UNDECANE	2.1	2.6	1.1	2.0	3.7		3.7
128 1235-TETRAMETHYLBENZENE					1.2		1.2
129 1234-TETRAMETHYLBENZENE							
130 1234-TETRAHYDRONAPHTHALENE							
131 DIISOPROPYLBENZENE							
132 NAPHTHALENE							
133 DODECANE		1.2		1.2	1.1		1.1

Table 6

## Hamilton 1986 Air Quality Survey

VOC data acquired upwind of Domtar

General

MONITORING PERIOD	A064	A143	A166		n/a	A154	
	OCT 6	OCT 14	OCT 16		OCT 6	OCT 15	
Sampling End Time	16:29	17:34	18:10	Average	11:47	16:20	Average
Total Compounds Identified	32	30	30	31	29	15	22
Total # of Peaks	73	75	100	83	89	45	67
Total Area of Peaks	8429	6702	29875	15002	11096	5135	8116
Area of Identified Peaks	5768	4754	23905	11476	6175	3099	4637
Area % Identified Peaks	68	71	80	73	56	60	58
Total Organic Conc. ug/m3	239.9	143.9	192.4	192.0	129.0	67.2	98.1
Alkanes ug/m3	112.9	73.7	125.5	104.0	64.9	43.9	54.4
Cycloalkanes ug/m3	7.1	2.2	2.0	3.8	1.0	0.0	0.5
Alkenes ug/m3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycloalkenes ug/m3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkynes ug/m3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aromatics ug/m3	67.0	44.6	47.5	53.0	53.7	13.3	33.5
Chlorinated alkanes ug/m3	45.7	21.8	14.5	27.3	9.9	11.0	10.4
Chlorinated alkenes ug/m3	7.2	2.9	4.4	4.8	2.0	0.0	1.0
Chlorinated aromatics ug/m3	0.0	0.0	0.0	0.0	0.0	0.0	0.0



Table 7

## Hamilton 1986 Air Quality Survey

VOC data acquired DOWNWIND of Columbian Chemical

UPWIND (Pier 24/25) VOC Data

MONITORING PERIOD	A082	A173	A173		A083
Sampling End Time	OCT 8 13:47	OCT 17 13:45	OCT 17 14:22	Average	OCT 8 15:58
1 ETHANE					
2 PROPANE	24.6	25.0	27.4	25.6	15.1
3 PROPADIENE					
4 PROPYNE					
5 CYCLOPROPANE					
6 CHLOROMETHANE					
7 2-METHYLPROPANE	10.6	3.1	4.3	6.0	3.3
8 CHLOROETHENE					
9 1-BUTENE					
10 2CHLORO2METHYLPROPANE					
11 1,3-BUTADIENE					
12 BUTANE	31.7	13.2	21.9	22.3	18.1
13 1-BUTYNE					
14 CHLOROETHANE					
15 3-METHYL-1-BUTENE					
16 2-METHYLBUTANE	20.5	5.2	10.0	11.9	11.0
17 1-PENTENE					
18 PENTANE	9.1	3.1	7.0	6.4	8.3
19 2-METHYL-1,3-BUTADIENE					
20 TRANS-2-PENTENE	1.9			1.9	
21 CIS-2-PENTENE					
22 DICHLOROMETHANE					
23 2-METHYL-2-BUTENE					
24 3-CHLOROPROPENE					
25 2,2-DIMETHYLBUTANE					
26 4-METHYL-1-PENTENE					
27 3-METHYL-1-PENTENE					
28 CYCLOPENTANE			1.0	1.0	1.2
29 TRANS12DICHOROETHANE		1.6	3.6	2.6	6.1
30 2,3-DIMETHYLBUTANE					1.6
31 2-METHYLPENTANE		1.9	4.3	3.1	9.1
32 3-METHYLPENTANE	6.5	1.3	2.7	3.5	8.0
33 1-HEXENE					
34 CIS-1,2-DICHLOROETHENE					
35 2-CHLOROBUTANE					
36 HEXANE	7.2	1.7	4.1	4.3	15.0
37 TRICHLOROMETHANE					
38 TRANS-3-HEXENE					
39 3-CHLORO-2-METHYLPROPENE					
40 METHYLCYCLOPENTANE			2.0	2.0	4.1
41 1,2-DICHLOROETHANE					
42 1,1,1-TRICHLOROETHANE	9.0		3.3	6.1	9.4
43 1-CHLOROBUTANE					
44 BENZENE	14.2	3.8	7.4	8.5	20.0
45 TETRACHLOROMETHANE					25.0

Table 7

## Hamilton 1986 Air Quality Survey

VOC data acquired DOWNWIND of Columbian Chemical

UPWIND (Pier 24/25) VOC Data

MONITORING PERIOD	A082	A173	A173		A083
Sampling End Time	OCT 8 13:47	OCT 17 13:45	OCT 17 14:22	Average	OCT 8 15:58
46 CYCLOHEXANE	1.8	2.2	9.3	4.5	1.4
47 2,3-DIMETHYLPENTANE			2.2	2.2	4.3
48 2-METHYLHEXANE			2.5	2.5	4.9
49 CYCLOHEXENE					
50 DIBROMOMETHANE					
51 3-METHYLHEXANE	2.8		1.5	2.1	3.4
52 1,2-DICHLOROPROPANE					
53 2,3-DICHLOROPROPENE					
54 TRICHLOROETHENE					
55 2,2,4-TRIMETHYLPENTANE	1.2			1.2	
56 1-HEPTENE					
57 HEPTANE	1.6		1.1	1.4	4.2
58 1-CHLORO-3-METHYLBUTANE					
59 TRANS-2-HEPTENE					
60 METHYLCYCLOHEXANE					
61 4-METHYLCYCLOHEXENE					
62 2,5-DIMETHYLHEXANE					
63 1-CHLOROPENTANE					
64 1,1,2-TRICHLOROETHANE					
65 TOLUENE	15.2	4.0	8.2	9.1	22.1
66 1,3-DICHLOROPROPANE					
67 2-METHYLHEPTANE					1.4
68 4-METHYLHEPTANE					
69 3-METHYLHEPTANE	1.8			1.8	2.5
70 1,2-DIBROMOETHANE					
71 1-OCTENE					
72 TRANS12DIMETHYLCYCLOHEXANE					
73 TRANS-4-OCTENE					
74 TETRACHLOROETHENE	3.6			3.6	1.6
75 2-METHYL-1-HEPTENE					
76 OCTANE	1.3			1.3	2.8
77 2-OCTENE					
78 CIS12DIMETHYLCYCLOHEXANE					
79 CHLOROBENZENE					
80 ETHYLCYCLOHEXANE					
81 PROPYLCYCLOPENTANE					
82 1-CHLOROHEXANE					
83 ETHYLBENZENE	3.5		2.3	2.9	6.1
84 M&P-XYLENES	9.3	2.5	7.3	6.4	16.7
85 4-METHYLOCTANE					
86 2-METHYLOCTANE					
87 STYRENE					1.9
88 3METHYLOCTANE					
89 1,4-DICHLOROBUTANE					
90 O-XYLENE	2.8		2.5	2.7	4.6

Table 7

## Hamilton 1986 Air Quality Survey

VOC data acquired DOWNWIND of Columbian Chemical

UPWIND (Pier 24/25) VOC Data

MONITORING PERIOD	A082	A173	A173		A083
	OCT 8	OCT 17	OCT 17		OCT 8
Sampling End Time	13:47	13:45	14:22	Average	15:58
91 1,1,2,2-TETRACHLOROETHANE					
92 1,2,3-TRICHLOROPROPANE					
93 1-NONENE					
94 TRANS-1,4-DICHLOROBUTENE					
95 NONANE	1.4			1.4	1.7
96 ISOPROPYLBENZENE					
97 2-CHLOROTOLUENE					
98 3-CHLOROTOLUENE					
99 N-PROPYLBENZENE					
100 4-CHLOROTOLUENE					
101 3-ETHYLTOLUENE			2.4	2.4	2.0
102 4-ETHYLTOLUENE					
103 1,3,5-TRIMETHYLBENZENE			1.5	1.5	
104 2-ETHYLTOLUENE					
105 1,2,4-TRIMETHYLBENZENE		1.3	3.0	2.1	1.9
106 tert-BUTYLBENZENE	4.0	1.2	3.4	2.9	3.9
107 t-BUTYLCYCLOHEXANE					
108 1,3-DICHLOROBENZENE					
109 1-DECENE					
110 (CHLOROMETHYL)BENZENE					
111 1,5-DICHLOROPENTANE					
112 ISOBUTYLBENZENE					
113 DECANE	3.4		1.7	2.6	2.1
114 sec-BUTYLBENZENE					
115 3-(CHLOROMETHYL)HEPTANE					
116 1,2,3-TRIMETHYLBENZENE			1.2	1.2	
117 ISOPROPYLBENZENE					
118 1,2-DICHLOROBENZENE					
119 INDAN					5.0
120 N-BUTYLCYCLOHEXANE					
121 1,3-DIETHYLBENZENE					
122 1,4-DIETHYLBENZENE					
123 N-BUTYLBENZENE					
124 1,2-DIETHYLBENZENE					
125 T-DECALIN					
126 C-DECALIN					
127 UNDECANE	16.5	1.8	1.5	6.6	3.6
128 1,2,3,4-TETRAMETHYLBENZENE					
129 1,2,3,4-TETRAMETHYLBENZENE					
130 1,2,3,4-TETRAHYDRONAPHTHALENE					
131 DIISOPROPYLBENZENE					
132 NAPHTHALENE	7.7	27.4	4.6	13.2	19.2
133 DODECANE	4.1			4.1	2.7

Table 7

## Hamilton 1986 Air Quality Survey

VOC data acquired DOWNWIND of Columbian Chemical

UPWIND (Pier 24/25) VOC Data

MONITORING PERIOD	A082	A173	A173		A083
	OCT 8	OCT 17	OCT 17		OCT 8
Sampling End Time	13:47	13:45	14:22	Average	15:58
Total Compounds Identified	27	17	30	25	38
Total # of Peaks	97	49	78	75	95
Total Area of Peaks	8808	4747	6643	6733	11651
Area of Identified Peaks	5434	2474	4199	4036	6020
Area % Identified Peaks	62	52	63	59	52
Total Organic Conc. ug/m3	217.3	100.2	155.0	157.5	275.0
Alkanes ug/m3	145.6	56.2	92.1	98.0	124.6
Cycloalkanes ug/m3	1.8	2.2	12.3	5.5	6.7
Alkenes ug/m3	1.9	0.0	0.0	0.6	0.0
Cycloalkenes ug/m3	0.0	0.0	0.0	0.0	0.0
Alkynes ug/m3	0.0	0.0	0.0	0.0	0.0
Aromatics ug/m3	56.7	40.2	43.7	46.9	103.3
Chlorinated alkanes ug/m3	9.0	0.0	3.3	4.1	34.4
Chlorinated alkenes ug/m3	3.6	1.6	3.6	2.9	7.7
Chlorinated aromatics ug/m3	0.0	0.0	0.0	0.0	0.0

Table 8

## Hamilton 1986 Air Quality Survey

VOC Data DOWNWIND of Dofasco

VOC Data DOWNWIND of Stelco

MONITORING PERIOD	A092	A092	A092		A093	A093	A102	A103	
Sampling End Time	OCT 9	OCT 9	OCT 9	Average	OCT 9	OCT 9	OCT 10	OCT 10	Average
	11:06	12:06	13:16		14:33	15:33	10:24	11:16	
1 ETHANE									
2 PROPANE	12.7	10.6	11.2	11.5	9.9	9.2	4.3	1.4	6.2
3 PROPADIENE									
4 PROPYNE									
5 CYCLOPROPANE									
6 CHLOROMETHANE									
7 2-METHYLPROPANE	3.6	2.8	2.5	2.9	5.1	4.8	2.3		4.0
8 CHLOROETHENE									
9 1-BUTENE									
10 2CHLORO2METHYLPROPANE									
11 1,3-BUTADIENE									
12 BUTANE	15.8	14.6	12.1	14.1	30.0	34.0	10.1	3.0	19.3
13 1-BUTYNE									
14 CHLOROETHANE									
15 3-METHYL-1-BUTENE									
16 2-METHYLBUTANE	12.4	9.9	7.2	9.8	17.7	26.6	6.0	1.9	13.1
17 1-PENTENE									
18 PENTANE	9.6	6.8	4.7	7.1	9.6	15.6	3.9	1.5	7.6
19 2-METHYL-1,3-BUTADIENE									
20 TRANS-2-PENTENE					1.3	2.5			1.9
21 CIS-2-PENTENE									
22 DICHLOROMETHANE									
23 2-METHYL-2-BUTENE									
24 3-CHLOROPROPENE									
25 2,2-DIMETHYLBUTANE									
26 4-METHYL-1-PENTENE									
27 3-METHYL-1-PENTENE									
28 CYCLOPENTANE	1.3	1.1		1.2	1.1	1.7			1.4
29 TRANS12DICHOROETHANE	4.8	3.7	3.0	3.8	5.5	8.9	2.5		5.6
30 2,3-DIMETHYLBUTANE					1.6	2.6			2.1
31 2-METHYLPENTANE	4.7	3.9	3.4	4.0	7.1	11.7	3.3	1.0	5.8
32 3-METHYLPENTANE	3.5	2.6	2.7	2.9	4.9	8.4	2.7		5.3
33 1-HEXENE									
34 CIS-1,2-DICHLOROETHENE									
35 2-CHLOROBUTANE									
36 HEXANE	5.5	4.3	3.9	4.6	6.5	10.5	5.0	1.2	5.8
37 TRICHLOROMETHANE									
38 TRANS-3-HEXENE									
39 3-CHLORO-2-METHYLPROPENE									
40 METHYLCYCLOPENTANE	2.1	1.7	1.5	1.8	3.0	5.1	1.5		3.2
41 1,2-DICHLOROETHANE									
42 1,1,1-TRICHLOROETHANE	8.1	6.9	9.7	8.2	4.7	5.0	6.0		5.2
43 1-CHLOROBUTANE									
44 BENZENE			21.9	21.9	18.5	34.6	5.9	42.7	25.4
45 TETRACHLOROMETHANE					4.7	23.3			14.0
46 CYCLOHEXANE						1.4			1.4

Table 8

## Hamilton 1986 Air Quality Survey

MONITORING PERIOD Sampling End Time	VOC Data DOWNWIND of Dofasco				VOC Data DOWNWIND of Stelco				
	A092 OCT 9 11:06	A092 OCT 9 12:06	A092 OCT 9 13:16	Average	A093 OCT 9 14:33	A093 OCT 9 15:33	A102 OCT 10 10:24	A103 OCT 10 11:16	Average
47 2,3-DIMETHYLPENTANE	2.7	1.8	1.8	2.1	3.9	7.2	1.8		4.3
48 2-METHYLHEXANE	3.1	2.1	2.0	2.4	4.4	8.3	2.1		4.9
49 CYCLOHEXENE									
50 DIBROMOMETHANE									
51 3-METHYLHEXANE	2.1	1.4	1.4	1.7	3.0	5.2	1.5		3.2
52 1,2-DICHLOROPROPANE									
53 2,3-DICHLOROPROPENE									
54 TRICHLOROETHENE									
55 2,2,4-TRIMETHYLPENTANE	1.1			1.1	2.9	5.0			3.9
56 1-HEPTENE									
57 HEPTANE	2.3	1.0	1.3	1.5	2.1	3.9	2.2		2.7
58 1-CHLORO-3-METHYLBUTANE									
59 TRANS-2-HEPTENE									
60 METHYLCYCLOHEXANE									
61 4-METHYLCYCLOHEXENE									
62 2,5-DIMETHYLHEXANE									
63 1-CHLOROPENTANE									
64 1,1,2-TRICHLOROETHANE									
65 TOLUENE	15.7	7.6	12.0	11.8	13.9	28.4	15.6	6.1	16.0
66 1,3-DICHLOROPROPANE									
67 2-METHYLHEPTANE						1.9	1.5		1.7
68 4-METHYLHEPTANE									
69 3-METHYLHEPTANE	1.9		1.2	1.5	1.5	3.8	1.6		2.3
70 1,2-DIBROMOETHANE									
71 1-OCTENE									
72 TRANS12DIMETHYLCYCLOHEXANE									
73 TRANS-4-OCTENE									
74 TETRACHLOROETHENE						1.5			1.5
75 2-METHYL-1-HEPTENE									
76 OCTANE	1.5		1.0	1.3	1.2	2.6	3.4		2.4
77 2-OCTENE									
78 CIS12DIMETHYLCYCLOHEXANE									
79 CHLOROBENZENE									
80 ETHYLCYCLOHEXANE									
81 PROPYLCYCLOPENTANE									
82 1-CHLOROHEXANE									
83 ETHYLBENZENE	4.8		2.8	3.8	3.5	6.9	23.1		11.1
84 M&P-XYLENES	15.3	5.9	9.6	10.3	10.8	23.5	75.3	2.7	28.1
85 4-METHYLOCTANE									
86 2-METHYLOCTANE									
87 STYRENE						1.3			1.3
88 3METHYLOCTANE									
89 1,4-DICHLOROBUTANE									
90 O-XYLENE	4.7	1.9	2.8	3.1	3.7	8.6	13.8		8.7
91 1,1,2,2-TETRACHLOROETHANE									
92 1,2,3-TRICHLOROPROPANE									



Table 8

## Hamilton 1986 Air Quality Survey

MONITORING PERIOD Sampling End Time	VOC Data DOWNWIND of Dofasco				VOC Data DOWNWIND of Stelco				
	A092 OCT 9 11:06	A092 OCT 9 12:06	A092 OCT 9 13:16	Average	A093 OCT 9 14:33	A093 OCT 9 15:33	A102 OCT 10 10:24	A103 OCT 10 11:16	Average
93 1-NONENE									
94 TRANS1,4-DICHLOROBUTENE									
95 NONANE	1.0	1.1		1.0	1.0	1.3	3.2		1.8
96 ISOPROPYLBENZENE									
97 2-CHLOROTOLUENE									
98 3-CHLOROTOLUENE									
99 N-PROPYLBENZENE									
100 4-CHLOROTOLUENE									
101 3-ETHYLTOLUENE	2.2	1.2	2.0	1.8					
102 4-ETHYLTOLUENE					1.2	2.6	3.9		2.6
103 1,3,5-TRIMETHYLBENZENE	1.4		1.1	1.3					
104 2-ETHYLTOLUENE									
105 1,2,4-TRIMETHYLBENZENE	3.1	2.2	2.7	2.6	5.4	11.2	14.4		10.3
106 tert-BUTYLBENZENE	3.7	3.0	1.8	2.8	7.3	14.3	19.9	1.4	10.7
107 tBUTYLCYCLOHEXANE									
108 1,3-DICHLOROBENZENE									
109 1-DECENE									
110 (CHLOROMETHYL)BENZENE									
111 1,5-DICHLOROPENTANE									
112 ISOBUTYLBENZENE									
113 DECANE	1.9	4.4	1.3	2.6	3.1	1.7	2.5	1.3	2.2
114 secBUTYLBENZENE									
115 3-(CHLOROMETHYL)HEPTANE									
116 1,2,3-TRIMETHYLBENZENE	1.2	1.0	1.1	1.1					
117 ISOPROPYLMETHYLBENZENE									
118 1,2-DICHLOROBENZENE									
119 INDAN									
120 N-BUTYLCYCLOHEXANE									
121 1,3-DIETHYLBENZENE									
122 1,4-DIETHYLBENZENE									
123 N-BUTYLBENZENE									
124 1,2-DIETHYLBENZENE									
125 T-DECALIN									
126 C-DECALIN									
127 UNDECANE	2.8	24.0	2.0	9.6	14.3	2.3	2.8	19.7	9.8
128 1,2,3,4-TETRAMETHYLBENZENE					1.3	2.3	1.3		1.6
129 1,2,3,4-TETRAMETHYLBENZENE									
130 1,2,3,4-TETRAHYDRONAPHTHALENE									
131 DIISOPROPYLBENZENE									
132 NAPHTHALENE		6.0	7.7	6.9	4.7	3.8		15.3	7.9
133 DODECANE	1.0	7.6		4.3	4.3			5.5	4.9

Table 8

## Hamilton 1986 Air Quality Survey

MONITORING PERIOD	VOC Data DOWNWIND of Dofasco				VOC Data DOWNWIND of Stelco				
	A092	A092	A092	Average	A093	A093	A102	A103	Average
	OCT 9	OCT 9	OCT 9		OCT 9	OCT 9	OCT 10	OCT 10	
Sampling End Time	11:06	12:06	13:16		14:33	15:33	10:24	11:16	
Total Compounds Identified	32	28	30	30	36	39	30	14	30
Total # of Peaks	83	77	82	81	99	129	121	45	99
Total Area of Peaks	7025	5913	5721	6220	8451	13905	13322	5365	10261
Area of Identified Peaks	4086	3327	3947	3787	6071	10440	7250	3842	6901
Area % Identified Peaks	58	56	69	61	72	75	54	72	68
Total Organic Conc. ug/m3	157.6	141.1	139.2	146.0	224.5	353.5	243.2	104.6	231.5
Alkanes ug/m3	90.3	100.0	59.7	83.3	135.0	167.9	63.4	36.5	100.7
Cycloalkanes ug/m3	3.4	2.8	1.5	2.5	4.1	8.2	1.5	0.0	3.4
Alkenes ug/m3	0.0	0.0	0.0	0.0	1.3	2.5	0.0	0.0	1.0
Cycloalkenes ug/m3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkynes ug/m3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aromatics ug/m3	52.0	28.8	65.3	48.7	70.1	137.5	173.1	68.1	112.2
Chlorinated alkanes ug/m3	8.1	6.9	9.7	8.2	9.4	28.3	6.0	0.0	10.9
Chlorinated alkenes ug/m3	4.8	3.7	3.0	3.8	5.5	10.4	2.5	0.0	4.6
Chlorinated aromatics ug/m3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 9

## Hamilton 1986 Air Quality Survey

General VOC data acquired in the vicinity of the Industrial Sector of Hamilton

MONITORING PERIOD	n/a	*	*	*			*	
Sampling End Time	OCT 6 11:47	A064 OCT 6 16:29	A083 OCT 8 15:58	A143 OCT 14 17:34	A153 OCT 15 11:52	A162 OCT 16 10:34	A166 OCT 16 18:10	Average
1 ETHANE								
2 PROPANE	9.4	5.2	15.1	5.9	5.1	7.5	23.0	10.2
3 PROPADIENE								
4 PROPYNE								
5 CYCLOPROPANE								
6 CHLOROMETHANE								
7 2-METHYLPROPANE	3.2	1.2	3.3	1.4	1.3	3.3	7.3	3.0
8 CHLOROETHENE								
9 1-BUTENE								
10 2CHLORO2METHYLPROPANE								
11 1,3-BUTADIENE								
12 BUTANE	15.3	6.1	18.1	5.5	5.7	12.0	35.2	14.0
13 1-BUTYNE								
14 CHLOROETHANE								
15 3-METHYL-1-BUTENE								
16 2-METHYLBUTANE	5.0	5.4	11.0	3.5	2.9	5.1	12.1	6.4
17 1-PENTENE								
18 PENTANE	3.6	4.9	8.3	2.7	2.0	2.9	7.6	4.6
19 2-METHYL-1,3-BUTADIENE								
20 TRANS-2-PENTENE								
21 CIS-2-PENTENE								
22 DICHLOROMETHANE								
23 2-METHYL-2-BUTENE								
24 3-CHLOROPROPENE								
25 2,2-DIMETHYLBUTANE								
26 4-METHYL-1-PENTENE								
27 3-METHYL-1-PENTENE								
28 CYCLOPENTANE		1.4	1.2					1.3
29 TRANS12DICHLOROETHANE	2.0	7.2	6.1	2.9		1.5	4.4	4.0
30 2,3-DIMETHYLBUTANE		2.4	1.6	1.2			1.5	1.7
31 2-METHYLPENTANE	2.2	14.2	9.1	7.1	2.0	2.9	5.7	6.2
32 3-METHYLPENTANE	2.1	15.6	8.0	7.0	1.5	3.1	4.2	5.9
33 1-HEXENE								
34 CIS-1,2-DICHLOROETHENE								
35 2-CHLOROBUTANE								
36 HEXANE	2.6	26.3	15.0	13.2	2.8	6.9	6.8	10.5
37 TRICHLOROMETHANE								
38 TRANS-3-HEXENE								
39 3-CHLORO-2-METHYLPROPENE								
40 METHYLCYCLOPENTANE	1.0	4.6	4.1	2.2		1.4	2.0	2.5
41 1,2-DICHLOROETHANE								
42 1,1,1-TRICHLOROETHANE	9.9	8.1	9.4	11.5	10.3	6.8	5.7	8.8
43 1-CHLOROBUTANE								
44 BENZENE	15.1	34.0	20.0	7.6	13.8	18.4	5.8	16.4
45 TETRACHLOROMETHANE		37.6	25.0	10.3			8.8	20.4

Table 9

## Hamilton 1986 Air Quality Survey

General VOC data acquired in the vicinity of the Industrial Sector of Hamilton

MONITORING PERIOD	n/a	*	*	*			*	
Sampling End Time	OCT 6 11:47	A064 OCT 6 16:29	A083 OCT 8 15:58	A143 OCT 14 17:34	A153 OCT 15 11:52	A162 OCT 16 10:34	A166 OCT 16 18:10	Average
46 CYCLOHEXANE		1.1	1.4					1.3
47 2,3-DIMETHYLPENTANE	1.3	6.9	4.3	3.7	1.1	1.2	3.0	3.1
48 2-METHYLHEXANE	1.5	7.9	4.9	4.2	1.2	1.4	3.4	3.5
49 CYCLOHEXENE								
50 DIBROMOMETHANE								
51 3-METHYLHEXANE	1.1	6.3	3.4	3.5			2.5	3.4
52 1,2-DICHLOROPROPANE								
53 2,3-DICHLOROPROPENE								
54 TRICHLOROETHENE								
55 2,2,4-TRIMETHYLPENTANE							1.4	1.4
56 1-HEPTENE								
57 HEPTANE	1.2	4.6	4.2	2.8			2.2	3.0
58 1-CHLORO-3-METHYLBUTANE								
59 TRANS-2-HEPTENE								
60 METHYLCYCLOHEXANE								
61 4-METHYLCYCLOHEXENE								
62 2,5-DIMETHYLHEXANE								
63 1-CHLOROPENTANE								
64 1,1,2-TRICHLOROETHANE								
65 TOLUENE	14.0	15.9	22.1	8.7	7.5	8.5	11.4	12.6
66 1,3-DICHLOROPROPANE								
67 2-METHYLHEPTANE			1.4				1.3	1.3
68 4-METHYLHEPTANE								
69 3-METHYLHEPTANE		1.6	2.5	1.7			1.9	1.9
70 1,2-DIBROMOETHANE								
71 1-OCTENE								
72 TRANS12DIMETHYLCYCLOHEXANE								
73 TRANS-4-OCTENE								
74 TETRACHLOROETHENE			1.6		1.7			1.7
75 2-METHYL-1-HEPTENE								
76 OCTANE		1.0	2.8	1.8			2.4	2.0
77 2-OCTENE								
78 CIS12DIMETHYLCYCLOHEXANE								
79 CHLOROBENZENE								
80 ETHYLCYCLOHEXANE								
81 PROPYLCYCLOPENTANE								
82 1-CHLOROHEXANE								
83 ETHYLBENZENE			6.1	4.6	2.5	2.6	5.5	4.2
84 M&P-XYLENES	6.3	7.2	16.7	15.1	7.5	9.6	17.4	11.4
85 4-METHYLOCTANE								
86 2-METHYLOCTANE								
87 STYRENE			1.9					1.9
88 3METHYLOCTANE								
89 1,4-DICHLOROBUTANE								
90 O-XYLENE	2.4	2.3	4.6	3.9	2.6	3.0	5.1	3.4

Table 9

## Hamilton 1986 Air Quality Survey

General VOC data acquired in the vicinity of the Industrial Sector of Hamilton

MONITORING PERIOD	n/a	*	*	*		*	
	OCT 6	OCT 6	OCT 8	OCT 14	OCT 15	OCT 16	OCT 16
Sampling End Time	11:47	16:29	15:58	17:34	11:52	10:34	18:10
							Average
91 1,1,2,2-TETRACHLOROETHANE							
92 1,2,3-TRICHLOROPROPANE							
93 1-NONENE							
94 TRANS-1,4-DICHLOROBUTENE							
95 NONANE	2.4		1.7	1.4			1.4
96 ISOPROPYL BENZENE							1.7
97 2-CHLOROTOLUENE							
98 3-CHLOROTOLUENE							
99 N-PROPYLBENZENE							
100 4-CHLOROTOLUENE							
101 3-ETHYLTOLUENE	1.9	1.3	2.0			1.8	1.4
102 4-ETHYLTOLUENE					1.0		1.7
103 1,3,5-TRIMETHYLBENZENE	1.9	1.0					1.0
104 2-ETHYLTOLUENE							1.5
105 1,2,4-TRIMETHYLBENZENE	3.9	2.7	1.9	2.1	1.6	1.9	2.3
106 tert-BUTYLBENZENE	5.0	1.5	3.9	2.7	2.0		2.7
107 n-BUTYLCYCLOHEXANE						1.0	
108 1,3-DICHLOROBENZENE							
109 1-DECENE							
110 (CHLOROMETHYL) BENZENE							
111 1,5-DICHLOROPENTANE							
112 ISOBUTYLBENZENE							
113 DECANE	6.8	1.2	2.1	1.9		2.0	2.8
114 secBUTYLBENZENE							
115 3-(CHLOROMETHYL)HEPTANE							
116 1,2,3-TRIMETHYLBENZENE	1.9	1.0					1.5
117 ISOPROPYL 4-METHYLBENZENE							
118 1,2-DICHLOROBENZENE							
119 INDAN			5.0				5.0
120 n-BUTYLCYCLOHEXANE							
121 1,3-DIETHYLBENZENE							
122 1,4-DIETHYLBENZENE							
123 n-BUTYLBENZENE							
124 1,2-DIETHYLBENZENE							
125 T-DECALIN							
126 C-DECALIN							
127 UNDECANE	3.7	2.1	3.6	2.6			1.1
128 1,2,3,5-TETRAMETHYLBENZENE	1.2						2.6
129 1,2,3,4-TETRAMETHYLBENZENE							1.2
130 1,2,3,4-TETRAHYDRONAPHTHALENE							
131 DIISOPROPYLBENZENE							
132 NAPHTHALENE			19.2				19.9
133 DODECANE	1.1		2.7	1.2			19.6
							1.7

Table 9

## Hamilton 1986 Air Quality Survey

General VOC data acquired in the vicinity of the Industrial Sector of Hamilton

MONITORING PERIOD	n/a	*	*	*			*	
	OCT 6	A064 OCT 6	A083 OCT 8	A143 OCT 14	A153 OCT 15	A162 OCT 16	A166 OCT 16	
Sampling End Time	11:47	16:29	15:58	17:34	11:52	10:34	18:10	Average
Total Compounds Identified	29	32	38	30	20	21	31	29
Total # of Peaks	89	73	95	75	53	54	100	77
Total Area of Peaks	11096	8429	11651	6702	5369	5195	29875	11188
Area of Identified Peaks	6175	5768	6020	4754	3525	3185	23905	7619
Area % Identified Peaks	56	68	52	71	66	61	80	65
Total Organic Conc. ug/m3	129.0	239.9	275.0	143.9	76.0	103.9	212.3	168.6
Alkanes ug/m3	64.9	112.9	124.6	73.7	25.6	48.4	125.5	82.2
Cycloalkanes ug/m3	1.0	7.1	6.7	2.2	0.0	1.4	2.0	2.9
Alkenes ug/m3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycloalkenes ug/m3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkynes ug/m3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aromatics ug/m3	53.7	67.0	103.3	44.6	38.4	45.8	67.4	60.0
Chlorinated alkanes ug/m3	9.9	45.7	34.4	21.8	10.3	6.8	14.5	20.5
Chlorinated alkenes ug/m3	2.0	7.2	7.7	2.9	1.7	1.5	4.4	3.9
Chlorinated aromatics ug/m3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

\* These samples were discussed in other sections of this report.